LIBRARY OF CONGRESS
MAY 29 1899
411367
SMITHSONIAN REPORT

THE AMERICAN GAS LIGHT JOURNAL

REDMAN&KENNY.N.Y.

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXX. No 22. Whole No. 1,251. | NEW YORK, MONDAY, MAY 29, 1899. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, New York.

Collections are invariably made directly from this office for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C. O. D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—
Twenty-second Annual Meeting, Western Gas Association..... 801

EDITORIALS—
Briefly Told 802
The Milwaukee Meeting of the Western Gas Associaaion—The Meeting of the Southwestern Gas, Electric and Street Railway Association.

Large Gasholders in England—No. II., by Mr. Norton H. Humphrys, C.E., F.C.S. 803
*Differential Rate Meter, by Mr. L. C. Reed 804
*The Kern Incandescent Gas Burner 806
Notes on Coal Tar and the Preparation of its Products 807
*Wind Pressure on Buildings and Other Structures, by Mr. J. O.V. Irminger 809
Special English Correspondence 813
The Antiseptic Gas Flame—A Relic of the Deposit System—A Pennyworth of Gas—The Institution of Gas Engineers—Death of Mr. Frank Livesey.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 814
Contract for the Logan Iron Works—Dividend, Laclede Company—Contract for the U. G. I. Company—Cheaper Gas for Alexandria, Va.—The Washington, D. C., Sale is Off—Organization of the Tennessee Gas and Coke Company—A Typographical Mistake—Everett's Bright Light—Death of Mr. A. T. Schuessler—A Memphis Ordinance—Annual Meeting, Atlantic City, N. J.—Dividends, Washington (D. C.) Company—Gas Works for Nelson, B. C.—A Hint from Clinton, Ia.—Contract for the Berlin Iron Bridge Company—Annual Meeting, Portland, Me.

A Novel Marine Illuminating Device 816
The Market for Gas Securities 816

[OFFICIAL NOTICE.]

Twenty-second Annual Meeting, Western Gas Association.

WESTERN GAS ASSOCIATION, OFFICE OF THE SECRETARY,
NEW ALBANY, IND., May 10, 1899.

To the Members of the Western Gas Association:

The twenty-second annual meeting of the Western Gas Association will be held in Milwaukee, Wis., June 14, 15 and 16, 1899.

The meeting will be called to order by the President, Mr. George Treadway Thompson, at 9:30 A.M., Wednesday, June 14.

Mr. E. G. Cowdery, Chairman of the Committee of Arrangements, reports that the Hotel Pfister has been selected as headquarters, and that the meetings will be held in its banquet room.

Arrangements for the entertainment of the guests are not as yet wholly completed. Those that have been determined upon are as follows:

A reception to the gentlemen and ladies present will be given by Mr. Cowdery at his residence on Wednesday evening.

A banquet, to be provided by the Association, in which the ladies will participate, will be held on Thursday evening in the main dining room of the Hotel Pfister. Several novel features will be introduced on this occasion, which will, it is believed, add very materially to the entertainment of guests, and it is urged that members do not fail to provide themselves with tickets in advance.

Tickets for banquet will be sold at $5 each, and will entitle the holder to all privileges of the excursion which will be provided for Friday.

As it is necessary that arrangements for this banquet and excursion should be perfected at a very early date, it is requested that all those who expect to attend the meeting will purchase their tickets, or notify the Committee as early as possible of the number of tickets they will require.

The gas works, the E. P. Allis works, the breweries and other places of interest, all of which will be easily accessible by electric cars, will be open to the inspection of visitors during the week. A list of such places will be made up, with directions for finding same easily.

Accommodations can be secured at the following first-class hotels, all within five minutes' walk of the Pfister:

Hotel.	American Plan.	European Plan.
Hotel Pfister	$3.00 to $5.00	$1.50 to $3.50
Plankinton House	3.50 to 5.00	2.50 to 3.50
Hotel Davidson	....	2.50 to 3.50
St. Charles Hotel	2.00 to 3.00	....
Schlitz Hotel	....	1.00 to 1.50
Hotel Blatz	....	2.00 to 5.00

The Executive Committee has arranged for the presentation of the following papers:

"Causes Underlying the Formation of Naphthalene and their Prevention," by Mr. Paul Doty, Grand Rapids, Mich.

"Vitrified Clay Pipes Instead of Iron for Gas Mains," by Mr. Irvin Butterworth, Columbus, O.

"Furnishing Gas at Higher Pressure and without Leakage," by Mr. F. H. Shelton, Philadelphia, Pa.

"A Foundation That Failed and the Lesson It Taught," by Mr. B. E. Chollar, St. Louis, Mo.

"Cyanides in the Gas and Waste Products at Columbus, O.," by Mr. E. E. Eysenbach, Columbus, O.

"Problems in New Business: Some History and Experiments," by Mr. F. B. Wheeler, Binghamton, N. Y.

"Wrinkle Department," edited by Mr. E. H. Jenkins, Buffalo, N.Y.

"Report of Committee on Isolated Generators for Bench Firing," by Messrs. F. Bredel, Irvin Butterworth and W. E. Steinwedell, Committee.

The Western Passenger Association, from points in Eastern and Trans-Missouri territories, the Central Passenger Association, Trunk Line Association, Southeastern Passenger Association, the Wisconsin Central Lines, Chicago, Rock Island and Pacific Railway Company, the Chicago and Alton Road, have granted rates of one and one-third fare for the round trip, conditional on 100 certificates being presented to the Secretary for indorsement. The territory embraced by the above Associations includes all States east of the Mississippi River, except New England. The following States and Territories west of the Mississippi River are in the territory covered by the railway associations granting reduction: North Dakota, South Dakota, Minnesota, Iowa, Missouri, Nebraska, Kansas, Oklahoma, Indian Territory, Colorado and Utah.

All persons attending the meeting will purchase a first class ticket at starting point, paying full fare for same, obtaining from agent a certificate stating that the person whose signature appears on same has purchased, at full tariff fare, one first class ticket to Milwaukee, which certificate, after it has been signed by the Secretary of the Association and a representative of the above Passenger Association, will entitle the purchaser to a one-third rate returning home.

Apply to ticket agent at least 30 minutes before departure of train. All station agents do not have a supply of certificates, but they can be obtained by request, if notification is made in time. Persons outside the territory embraced by the Passenger Associations mentioned above should purchase a ticket to nearest point within one of said Association, and from there purchase a ticket to Milwaukee, obtaining a certificate which will, if properly endorsed in Milwaukee, entitle them to a one-third fare returning to place from which certificate was obtained, provided it is endorsed by a representative of the Passenger Associations, who will be present at the meeting, and the undersigned.

Those who live in Western Passenger Association territory should consult local agents several days in advance of purchasing ticket to Milwaukee, in order to reach an understanding with the different roads as to the junction point via which they will make rates applicable. Some local agents sell to junction points, where delegates can rebuy to destination. Certificates held by wives of the delegates attending the meeting will be honored in the same manner as those held by the delegates themselves.

All queries sent the Secretary for the "Question Box" will be assigned to members for answers.

Mr. E. G. Pratt, of Des Moines, Iowa, is Chairman of the Committee on Extension of Membership, from whom, as well as any of the local committeemen, blank applications for membership can be obtained.

The Secretary will be pleased to answer any communication pertaining to the meeting, and will mail blank applications to any who desire to become members of the Association.

JAMES W. DUNBAR,
Secretary.

BRIEFLY TOLD.

THE MILWAUKEE MEETING OF THE WESTERN GAS ASSOCIATION.—The Milwaukee meeting of the Western Gas Association, which marks the first year of the Association's passing from its majority, promises to be up to its former assemblings, for the "plan and scope" arranged and predicted show that President Thompson, Secretary Dunbar and their associate committeemen have planned well and in no narrow scope. In fact, the preliminaries, as disclosed by our official notices respecting the reunion, leave no ground for complaint or cavilling, either on the score of inadequacy or incompleteness, as to the technical or social aspects of the gathering at Milwaukee. From present indications the East proposes to invade the West in goodly numbers, and a word of advice to those who will travel with the sun may not be amiss. A plain statement over this latter suggestion would be that the voyagers from eastern territory should plan to reach Milwaukee by some time of Tuesday, June 13th, since the early morning trains to Milwaukee from Chicago do not arrive until 11 A.M. This would mean that the earliest Chicago bird, leaving Wednesday morning, could not arrive in Milwaukee until an hour and a half after the time named for the opening of the convention. In consideration, too, must be taken the fact that an evening's rest in Milwaukee will enable the voyagers to enjoy all the more the attention of their hosts. It is again suggested that those who propose to purchase banquet tickets, which tickets entitle the holders to share in the balance of the entertainment, as was explained in the last issue of the JOURNAL, should communicate at once with Mr. Edward G. Cowdery, Chairman of the Entertainment Committee, so that he and his associates may have fair forewarning of the number for whom they shall provide. In connection with this entertaining of the Association a word might properly be here written, by referring to an invitation the parallel of which has not been drawn by any other member of the Association, save one who is or was enrolled in the Society of Gas Lighting. We refer to the invitation extended by Mr. and Mrs. Cowdery to the Association and its guests to meet them at their home, 633 Lake avenue, the evening of Wednesday, June 14th. Liberty, fraternity and equality may go no further, and the Cowdery invitation goes to show that fraternity still lives amongst those who, not being traders in the brokerage sense, have the best interests of their calling at heart.

THE MEETING OF THE SOUTHWESTERN GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION.—Here are two stories, respecting the first annual meeting of the Southwestern Gas, Electric and Street Railway Association, held in Austin, Texas, May 17, 18 and 19, as furnished by special correspondents. "W. E. L." says, under date of the 20th inst.: "The Southwestern Gas, Electric and Street Railway Association has just closed a most successful meeting that lasted three days. Interest in the proceedings was well sustained throughout and many well thought out papers were presented and discussed. The newest gas men present, so far as this territory of the industry is concerned, were Messrs. Jenkins—formerly of Buffalo, N. Y.; W. S. Rathell, of Waco; and the 'Man from Austin.' The officers elected were: President, Mr. Thomas D. Miller, Dallas; Treasurer, F. Fries, San Antonio; Secretary, T. H. Stuart, Waco—if you scan the list, even casually, you will note they are all gas men. The social features of the convention, which were nothing short of brilliant, included a reception at the home of President Drake—whose address, by-the-way, was commonsense, and, therefore, useful; a reception at the State House, by Governor Sayers; a general jubilation at the Driskill Hotel, and excursions wherever one cared to go. The meeting was a success, and the gas men seemed to have much the best of it." The second account of the meeting is from "One Who Attended." He thus writes under date of the 19th inst.: "The first annual meeting of the Southwestern Gas, Electric and Street Railway Association closed to-day. Many expressed the belief that the attendance was much smaller than it otherwise would have been had the meeting been held in April, as originally intended. As it was, however, 150 badges were given out, which, through the hospitality of the Street Railroad Companies, enabled the wearers thereof to ride wherever and whenever they liked during the progress of the meeting. The weather was the perfection of the climate of Texas—beautiful and balmy spring. Fleecy clouds occasionally tempered the rays of the sun, and at all times the heat from the greatest of orbs was sufficient to cause the breath of the Gulf to be welcomed for its caress. The meeting was commenced at 10 A.M., Wednesday, the 17th, with a right good attendance for a first day. President Drake introduced Mayor McCall, who extended the hospitalities of the city in his usual happy style, and was met by a neat response from Mr. T. D. Miller, of Dallas. Routine business, such as the appointment of committees, etc., was followed by a resolution to adjourn until 10 A.M. of Thursday. The interval was taken up by a reception at the State House, where we were cordially welcomed by Governor Sayers. The Governor's remarks were on the surface very flattering to the objects of the Association. Mr. Ira H. Evans responded to the Governor's welcoming. Thursday morning we listened with close attention to President Drake's address. Then came the reports of the officers and the reading of and discussion on the paper by Mr. Stuart on "Summer Amusements for Street Railway Companies" Friday, though, was the business day. Several papers came up 'missing.' The only paper that could be called a gas paper was that read by Mr. T. D. Miller, which seemed to prove as much electric as gas, if one might determine by the discussion—its title was 'The Art and Science of Selling Gas.' The Question Box followed the set papers, and the talk over its contents was brisk and varied. The officers elected were: President, T. D. Miller, Dallas; 1st V. P., J. F. Strickland, Waxahachie; 2d V. P., C. A. Yeager, Laredo; 3d V. P., W. E. Hamilton, Shreveport, La.; Secy., T. H. Stuart, Waco; Treas., Fred. Fries, San Antonio. Waco, Houston and Detroit extended invitations to the Association as suitable places for holding the next annual meeting. Waco, though, had the strongest lobby, and so won the day. The third Wednesday in May, 1900, was the time named for the opening. Everyone present was well pleased with the success of the meeting, and all promised to be on hand in Waco next year to 'take care of Miller.' The usual resolutions were passed, but let me say they were adopted in a spirit that savored of unusual effervescence and enthusiasm."

[Written for the JOURNAL.—Continued from Page 764.]

Large Gasholders in England.—No. II.

By Mr. NORTON H. HUMPHRYS, C.E., F.C.S.

With the increase in size of the gasholder there has been an important reduction of cost, and the chief causes of this important advance may next be considered. The first is the multiplication of lifts. We have noticed that many years elapsed before telescoping of gasholders became common. And even after that, a quarter of a century's rest was necessary to recoup the exertion consequent upon adopting the double-lift. A few three-lift holders were built, but attracted little general attention, being regarded as curiosities designed to meet particular circumstances rather than good examples for general imitation. But now that four or even six lifts have proved to be reliable and safe in working, one cannot help regretting that the movement in this direction has been so slow. A tank that will do for one lift will be equally effective for six, and, with the exception of some addition to the strength of the piers, will not cost more. The cost of the tank and of its erection usually runs into more than half of the total expense of a single-lift holder, and, therefore, by the simple plan of putting three lifts in place of one, we get approximately threefold capacity for less than double cost, and with four or six lifts the advantage is still greater.

One disadvantage attached to multi-lift holders is the variation of pressure. The reduction of the heavy pressure given when nearly all the lifts are cupped is a simple matter, and the trouble comes in with the upper lifts. A top lift, having a diameter equal to six times its height or more, especially if the roof is untrussed, must be weighted artificially to get a sufficient distributing pressure; or the gas must be pumped out of it. When the double-lift holder was first introduced it was the rule to make the top lift heavy enough to give the desired pressure and to counterbalance the bottom lift. But this is now quite obsolete, and counterbalanced holders are a thing of the past. The balanced gasholder is a relic of the pre-exhauster days. Various suggestions for meeting this difficulty have been proposed from time to time, but I have never heard that they were actually put into practice.

In connection with this point a paper read by Mr. J. Wright, before the North of England Association of Gas Managers, in 1888, is worthy our careful attention. The author limited the scope of his paper to the cost (*a*) of complete holders and tanks; and (*b*) to the cost of putting in a second or third lift, with a view of showing the great saving effected by simply adding another lift, instead of another holder and tank, to the storage capacity. Under the first heading, the cost of 11 various sized holders and tanks, ranging from 55,000 up to 1,000,000 capacity, was given. The total cost ranged from £1,650 to £9,500, or from £30 per 1,000 cubic feet for the smallest, to £9.5 for the largest. Then it was shown that the cost of increasing the storage to a similar extent, by means of lifts added to the existing holders, ranged from £11.8, for 55,000, to £6 for 1,000,000, at per 1,000 cubic feet added. The advantage in favor of telescoping ranges from 60 to 37 per cent. Apart from expense, it is something to avoid the trouble and risk that are inseparable from the construction of a gasholder tank.

But telescoping, though the chief, is not the only direction in which progress has been made. The next in order is the substitution of cement concrete for brickwork, which means a large saving both of material and labor, together with increased strength. Concrete is not only easy of erection, requiring no skilled labor, but it is also stronger than brick. It offers every facility for the incorporation within its substance of iron bands, and concrete strengthened with iron ties is in some respects a perfect material. The iron being enclosed is preserved from corrosion or changes of temperature, and we have the weight and rigidity of the masonry tank, combined with the strength of the iron tank, without the inelastic brittleness of the one, or the contraction and expansion of the other. Gas works are continually producing large quantities of hard clinker, broken brick, old retorts, etc., that are very suitable for aggregate, but which only realize low prices if offered for sale. By exercising a little foresight, sufficient material can be saved up in the course of a few years to supply all that is wanted.

A great improvement in the cost of guide-framing has also been effected. The earliest pattern of guiding—that is, for holders of moderately large size—is the column and girder, which may be described as a comparatively small number of heavy columns, joined at the top by horizontal girders. These columns would sometimes be placed as much as 50 feet apart, necessitating a very heavy cross girder. Specimens of these might be instanced, having a depth of as much as 4 or 5 feet. One effect of setting the columns so far apart was that the horizontal girder ran a considerable distance inside the circle described by the circumference of the holder, so that it had to be carried clear above the highest rise of the same. There were several feet of framing, therefore, actually above the holder. It was not practicable to connect the colomns except in this manner, as an intermediate girder at half the height was out of the question. The result was that, for holders of 150 feet diameter or upwards, the guide framing was ponderous and costly. When the practice of telescoping became general, the need of some horizontal connection at about half the height of the columns, as well as at the top, was evident.

Although columns may be seen as high as 60 feet or more without horizontal support, they must be very strong and heavy, as the strain at the base during a high wind is great. And I believe that all the holders that have been overturned or displaced by wind were guided by framing of this pattern. It was also observed that, by placing the columns closer together, the 5 feet horizontal girder could be displaced by something much higher and cheaper, that need not overlap the track of the holder at the top, so that the paving could be lowered a few feet, the holder rising inside it to the top edge, instead of having to keep clear below it. So a lighter form of column came into use, with two or more tiers of horizontal connecting girders. The next advancement was in the direction of further reduction in the weight of the columns and girders, and the use of diagonal tie rods. Then the cylindrical form of column was displaced by lighter sections. The column in fact ceased to be regarded as a column, and became a girder. This led the way to the use of wrought iron in place of cast, and so the use of the girder and column has gradually been displaced by a cylindrical framing consisting of uprights a short distance apart, tied together at close intervals by stiff horizontal members, by diagonals, or, as in Cutler's framing, by stiff struts at an angle of about 30°. This framing, instead of being carried 4 or 5 clear above the top of the holder, is sometimes stopped short at three-fourths or two-thirds the height, the top lifts being allowed to rise clear when the holder is full. So the proportional cost of the guide framing, formerly a considerable item, is now of far less importance, and the margin left for inventors of columnless systems to work on is small. The holder must have support and wind resisting power, and if this is not furnished by the usual outside framing, additional strength must be provided at the points to which the strains are transmitted. The curb and the perpendicular side supports inside the holder must be more rigid, and the remarks previously made about the need for greater strength and rigidity at the top edge of the tank apply with more force if the external framing is dispensed with.

For a good example of modern gasholder construction, which, while including the modern type of guide framing and several other improvements in detail, avoids such new departures as dispensing either partially or wholly with guide framing, we may refer to the treble-lift holder erected at the Bradford Road works of the Manchester Corporation, in 1897, from the designs of Mr. G. Ernest Stevenson, M.Inst.C.E. The respective diameters of the lifts are: 250 feet diamter by 50 feet high; 247 feet diameter by 50 feet high; 244 feet diameter by 50 feet 6 inches high. Its storage capacity is, therefore, over 7 million cubic feet. The crown rises 20 feet, and the three outer rows of sheeting are respectively ⅜ inch, ⅓ inch, and ¼ inch thick, the remainder being No. 9 B.W.G., and the size of the sheets 6 feet by 3 feet. The side sheeting consists of vertical strips, joined by horizontal strips, about 14 feet long and 3 feet wide, and there is a vertical stay behind each vertical strip. The cups and drips are Piggott's pattern, 24 inches deep and 12 inches wide, made of ½-inch plates, and the bottom curb is very strong, comprising a flange 12 inches wide of ¾-inch plate and a ring of 8-inch by 3½-inch steel channel joined by the the roller carriages and gusset brackets. The guide framing embraces 28 standards and 6 tiers of horizontal girders. The front and back members of the standards are 16 inch by 6 inch steel joist, joined by strong T-struts and lattice bars, and secured to heavy sole plates at the base. The top row of girders is of box pattern, and the intermediate girders are disposed horizontally. The diagonal ties are flat bars of various sections, ranging from 9 by ¾-inch at the bottom, to 4 by ½-inch at the top, and the guide carriages have both tangential and radial rollers. With the exception of the cast iron sole plates for the columns the whole structure is of steel.

It is interesting to compare this with a three-lift holder of similar size erected at the Kensal Green Station of the Gas Light and Coke Company, from the designs of Mr. G. C. Trewby, in 1892. The tank is 250 feet diameter by 55 feet 6 inches deep, and the dimensions of the lifts are, respectively, 247 feet, 244 feet and 241 feet in diameter by 55 feet deep. The capacity is 7,500,000 cubic feet, and the height of the columns 166 feet 6 inches. The tank was built of concrete, nearly 20,000 tons bei 1 1 required, and 13 tons of hoop iron were built into it. The

thickness of the wall at the base was 5 feet 9 inches, diminished by five offsets to 3 feet 9 inches at the top, and 2 feet of puddle was put in behind the wall. The rise of the crown was 18 feet, and the thickness of the sheeting ⅛ inch, with plates varying from $\frac{7}{16}$ to ¼ inch near the curbs. The total weight of the holder was 1,095 tons, that of the guide framing about the same, and the cost of the holder and tank, in round figures, £84,000, or about £11 8s. per 1,000 cubic feet capacity. The guide framing was composed largely of lattice work, the uprights being box pattern.

A holder and tank of about the same capacity was also erected at the Beckton station of the Gas Light and Coke Company from the designs of Mr. Trewby. The tank was built of concrete, 250 feet diameter by 45 feet 6 inches deep, and was located in a solid stratum of blue clay. The concrete was composed of 9 parts ballast to 1 of Portland cement, and at nine points in the tank there were insets of hoop iron bond. The iron was 1½ inches wide by $\frac{1}{16}$ inch thick, the number of strips in each inset ranging from eight at the bottom to four at the top, and 2 feet of puddle was put in at the back of the wall. A wooden frame was erected in the tank for the support of the holder when grounded. There were four lifts in the holder, of 247, 244, 241 and 238 feet diameter, respectively, each 45 feet deep and representing a total rise of 174 feet. The upright standards were 180 feet high and 28 in number, of box section, made up of steel angles connected by lattice bars. Both radial and tangential rollers were used. The horizontal girders comprised six tiers, the top one of box lattice type and the remainder plain lattice, placed horizontally, and joined at the corners by diagonal tie rods. The only cast iron about this holder was the sole plates for the columns, which rested on flat stones, 7 feet 6 inches by 7 feet by 1 foot thick.

(To be Continued.)

Differential Rate Meter.

[By Mr. Lyman C. Reed, in *Electrical World.*]

The origin of the modern practice of differential charging for current consumed, arose from the assumption that the consumer's load line corresponded in a measure with the load line of the central station. It

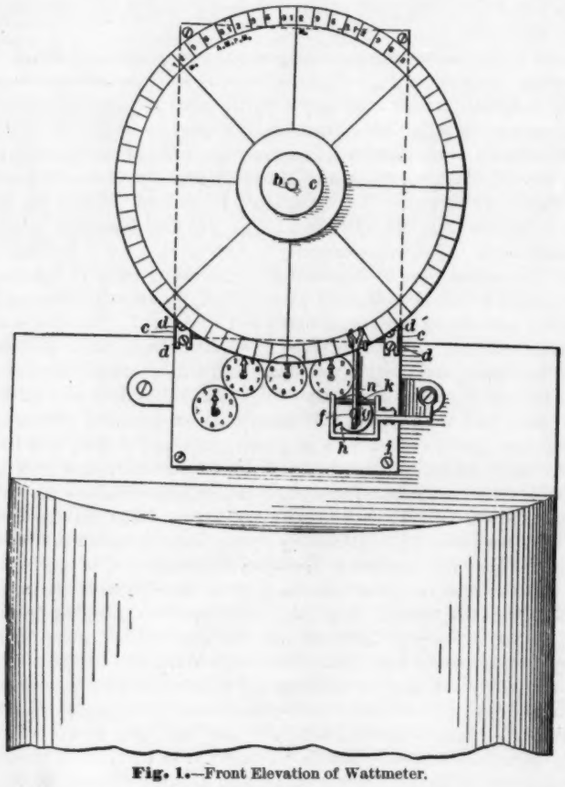


Fig. 1.—Front Elevation of Wattmeter.

is manifest if the consumer used a fixed amount of current each hour of the 24, no meter would be needed or a differential rate charged. The needs of the consumer are ever subject to change, hence a meter is preferable to a flat rate. A differential rate on a meter basis is still an advance on the usual flat meter rate, but difficulty has hitherto been found in obtaining in a cheap way the load curve of the consumer's burning. It is essential in fixing a differential rate to have a load curve of the consumer's burning at hand to note the time of his local peak and minimum burning and the duration of each, also the hours in which no light is consumed.

The leading systems of to-day are the "Wright Demand," 2 rate meter, and the ratio method of apportioning the total amount consumed,

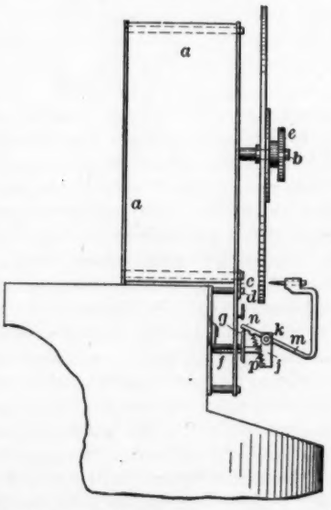


Fig. 2.—Side Elevation.

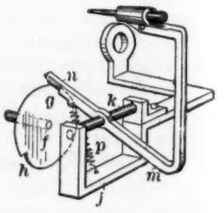


Fig. 3.—Detail Perspective View.

to each lamp installed, at a certain rate per kilowatt up to a fixed number of kilowatts, the remainder left being charged for at a lower rate.

The "Wright Demand" system for differential charging seems to have met with the most general favor, since each consumer is charged according to the cost of supplying his demand on the plant, with a profit added. The consumer's demand on the plant is ascertained by a recording ammeter, which indicates that at some period during the month a certain maximum quantity of current was consumed. It is impossible to tell at what time this maximum current was consumed or how long it remained on, whether for five minutes or one hour. Such a demand meter only furnishes a very rough method for differential charging, as the maximum demand may have occurred at a time when it benefited the load curve of the plant instead of augmenting the peak.

Nearly all current sold is measured by wattmeters, and the total amount consumed is ascertained at regular fixed intervals. The total current consumed for one month being thus obtained, the question arises, At what rate should this current be charged? It is this question that the three systems mentioned above attempt to solve, but, as is readily seen, only an approximation is reached by any one of the three.

A device that would take the total number of watt hours registered for a given period and break it up into its component parts, telling how long the maximum load was on, how long the minimum, and also when no lights were burned at all, each day, gives a complete load curve of the consumer and furnishes a perfect basis for differential charging.

Such a device we will proceed to describe, giving three views and also some load curves obtained from an instrument in actual service. The object of the device is to show through the medium of recording mechanism the differences in the load of any measuring and recording meter with regard to the time in which a certain quantity of fluid has been registered The purpose is to indicate visibly whether the given quantity has been registered uniformly or variably; if variably, the hours, or between what hours the variation occurred. For example, if a wattmeter registers 5,000 watt hours in 24 hours, it is desirable to know whether this quantity has been registered at a uniform or a variable rate, and if variable, between what hours the variation in load consumed occurred. If 3,000-watt hours have been registered between 4 P.M. and 9 P.M., and the remainder during the rest of the 24 hours, the information is desirable and important for determining the basis of charge for the quantity of current consumed. The device is not limited to the use of electric meters entirely, but will operate on any meter which by means of a registering train records the energy passing through it.

The manner in which the objects set forth are attained will be better

illustrated by referring to Fig. 1, which shows a broken front elevation of a wattmeter with the device in operative connection therewith, Fig. 2 being a broken side elevation of the same. Fig. 3 is a detail perspective view of the marking carrier on which the marker is mounted, showing also the detachable bracket or frame for supporting the carrier, and the rotary cam disk or wheel, which serves to actuate the carrier at certain intervals.

Fig. 1 indicates a T.-H. wattmeter, having a clock frame *a*, containing an 8-day, 30-day, or a self-winding movement rotating arbor *b*, on which is mounted a dial subdivided into 8-day or 30 day divisions, as the case may be, by radial lines, each designed to indicate 24 hours. Short radial lines further subdivide this space into 3-hour divisions. As the diagram shown indicates an 8-day clock movement, the description will be confined to this form for the purposes of the present discussion.

The clock movement is attached by straps *c* and *d*, to the meter dial as shown. The chart dial is detachably secured to its arbor by washer 10 and a thumb screw *e*, allowing the chart to be easily replaced by a new one. The shaft *f* (Fig. 2), which usually carries the index pointer for the initial or primary dial, extends from the point of the dial plate a sufficient distance to carry a disk shaped cam *g*, the cam portion of which is in the form of a pheripheral notch, having a rounded edge, as shown at *h* (Fig. 1.) In front of the cam disk is arranged the removable bracket *j*, secured to the meter frame by a screw which is also used to secure the dial to the meter frame. The bracket *j* supports a small oscillating spindle *k*, at the center of which is mounted an oscillating pencil or stylus, shaped as shown in Figs. 2 and 3.

The lower arm *m* is mounted between its front and rear end portions on the spindle in such manner as to allow a tail piece *n* to extend towards the dial plate and bear on the cam *g* as shown. The tail piece *n* is secured in this position bp a spring *p*, for the purpose of holding it in contact with the periphery of the cam disk, causing it to spring into the notch once for every revolution of the cam.

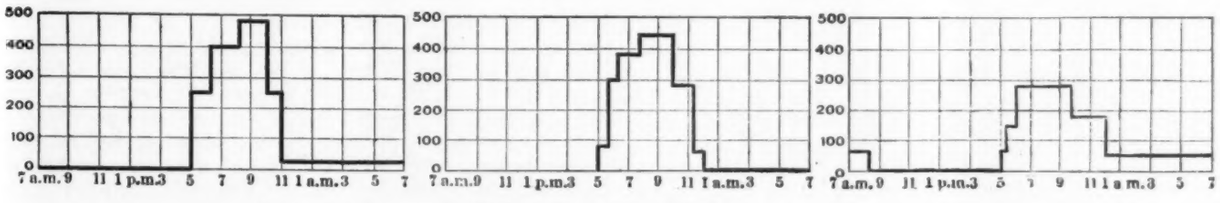
The point of the pencil is arranged the proper distance from the chart so that a dot is made on the chart for every revolution of the cam. The cam and tail piece are both brought to knife edges to reduce friction, and the tension of the spring is made very slight. The cam can be provided with a number of notches and be made to represent any desirable unit less than that represented by one complete revolution of the cam. The working of the device should now be obvious without any further explanation, as it will be seen that a fixed unit is recorded on the chart at intervals, the distance between the dots being the time consumed in recording the unit. It will be seen that this instrument indicates also the time of day at which the unit recorded was consumed. Should the meter stop while the pencil point is in contact with the disk or ribbon, a line is marked which indicates that no current was consumed for the period covered by the line. The stoppage of the line indicates the time at which the current was again turned on. The reading of the charts becomes readily familiar in a short while, a quick succession of dots indicating a heavy load, dots at long intervals showing light load. A load curve is easily plotted by making the hours the ordinates and the abscissae the units into which the cam disk is divided. The curves shown in Figs. 4, 5 and 6 were obtained in this manner.

The disk-shaped cam takes the place of the initial dial hand, and one of the notches (if there is more than one) is selected to represent the pointer. One of the possible objections which might be raised to an attachment of this kind is that it adds to the frictional load of the meter. By actual trial the frictional load added was found to be so small as to be entirely unappreciable on the smallest load of one 16-candle power lamp, proving that the accuracy of the meter is in no wise affected.

Some load curves obtained from a private residence illustrate admirably the nicety with which the amount of light consumed at different hours can be obtained. The curves given here were plotted directly from charts obtained from a residence containing 21 16-candle power lamps. On meters of large capacity it is desirable to have a number of notches in the disk, dividing into, say, 500 watt-hour units, the number of notches being readily ascertained by noting the constant of the meter. For example, a meter with constant ½ would need one notch to give a 500 watt-hour unit. A meter of this size if used on five to ten lights should be provided with a cam giving 50 or 100 watt-hour units, the units being of 6 or 12 minutes duration if a full load of ten lights were being burned. The load curves given in Figs. 4, 5 and 6 were obtained from a meter having for its constant unity, the cam being divided into 250-watt-hour divisions.

A few words relative to the actual operation of this device by the central station are not considered out of place. The clock used would be preferably a self-winding one operated by current from the service connection. For the rotating disk may be substituted a ribbon, such as those used on steam gauges, having the days, hours, etc., marked on it. The ribbon can be of indefinite length—long enough, we will say, to last six months, the divisions in hours and days being dated so as to correspond to the time kept by the clock. At the visit of the meter reader the ribbon chart used for the month is removed and returned to the office along with the reading. It may be arranged so that a carbon copy of the ribbon chart can be taken at the same time, and given to the consumer if desired. After several months, if the load curve remained proportionally the same, the clock attachment could be removed, as the rate by that time could be obtained from the curves furnished for several months.

A diagrammatic chart which shows exactly when and for how long the consumer's lights were burned according to the hour and day of the month, would be of untold importance in settling disputed bills. It would be impossible for a consumer to claim that no light was used after certain hours if the chart showed that such was not the case, and on the consumer's side the chart would be of great advantage in making him aware of any waste. The percentage due to error from all causes in a well managed meter department falls below ½ of 1 per cent., but the disputed bills range from 2 to 5 per cent. The disputes are due to a lack of knowledge of the amount of light consumed, or to a desire to get a rebate or make a delay in payment. It is this class of complaints which could be most readily and effectually settled by means of the chart, showing the exact time of the burning of the lights.



Figs. 4, 5, and 6.—Load Curves.

The attachment is inexpensive, as reliable clock movements are obtainable at a low figure, and the other parts of the apparatus are all detachable and simple in construction.

Thus we have a simple method of obtaining a correct basis for differential rating which in point of simplicity and correctness of results is far in advance of any of the present systems. The advantage of having the device a simple attachment is evident, since no extra wiring has to be done, and no extra space is required except a vertical distance of 4 inches. The only change needed in adapting it to the present type of wattmeter is a cover tall enough to inclose the attachment in the same compartment with the meter. The parts are few and simple, the action positive in its nature.

The universal application of this device to all forms of gas, water or oil meters which indicate by means of dials is of great value in ascertaining the amount consumed for a given period. As an illustration of its usefulness on a water meter, suppose the device was attached to the meter on the feed pipe of a set of boilers. The efficiency of the boilers and engines under different loads would be readily obtainable by comparing the water curve with the engine output curve.

The device can be attached to the main wattmeters in a plant, and a curve plotted from the results which should tally closely with the curve obtained by ampere readings, only the curve would represent watt output instead of ampere output. A meter placed on the oil tank in a central station with this device attached would check up the use of oil on the different watches, any undue waste being in that way traceable to its source.

The many and varied uses to which this instrument may be applied are too numerous to mention, but its special adaptability lies in obtaining the load curve of the consumer's meter.

The Kern Incandescent Gas Burner.

On October 4th, 1898, U. S. Letters Patent (No. 611,914) were granted to Mr. Ottmar Kern for certain useful improvements in incandescent gas burners. Using the words of the specification :

My invention has reference to incandescent gas burners designed to raise a mantle or hood of refractory material to a state of hyperincandescence by a self-burning mixture of air and illuminating gas or air and natural gas.

The present invention is in the nature of an improvement upon the incandescent gas burner for which Letters Patent of the United States, No. 574,805, were granted to me on January 5, 1897.

In my aforesaid patent I have shown, described, and claimed as an element of the incandescent gas burner an improved Bunsen burner composed of an upwardly converging hollow mixing cone and an upwardly diverging hollow suction cone, and while such Bunsen burner gave results that were far superior to those of Bunsen burners of ordinary construction I have ascertained that the self-burning mixture of gas and air is more completely realized when the contour of the tube of the burner is changed in accordance with my present invention.

Fig. 1.

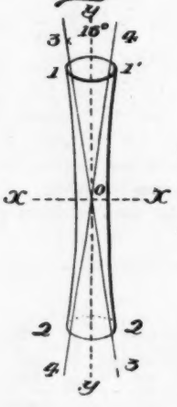


Fig. 2.

Fig. 3.

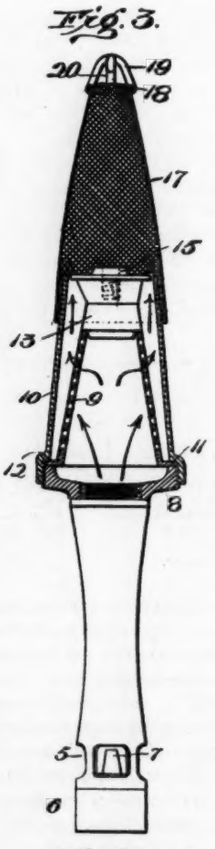
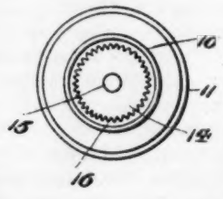


Fig. 4.



My present improvement, therefore, relates mainly to the particular contour of the interior of the Bunsen burner, but also extends to other portions of the burner, as will be hereinafter more fully explained with reference to the accompanying drawings, in which :

Figure 1 is a diagram illustrating the principle upon which the construction of the improved Bunsen burner is based. Fig. 2 is a longitudinal section of a Bunsen burner constructed in accordance with this principle. Fig. 3 represents the incandescent gas burner, showing the Bunsen burner portion in elevation and the upper portion of the device in longitudinal section ; and Fig. 4 is a top plan view of the burner with the mantle of refractory material removed.

Like letters and numerals of reference indicate like parts.

Referring to Fig. 1, the curves 1 2 and 1′ 2′ represent the two branches of a hyperbola, the coordinates of which are indicated at $x\,x$ and $y\,y$ and the asymptotes by 3 3 and 4 4. If such hyperbola is rotated about the axis $y\,y$ it generates a hyperboloid, such as indicated in Fig. 1, and I have found that the geometrical characteristics of such hyperboloid have a particular physical significance, which becomes important when utilized in the construction of a Bunsen burner for an incandescent gas burner. The geometric characteristic of such hyperboloid here considered is that the increase of area of its tranverse cross sections is directly proportional to the square of the distance of that cross section from the point of intersection O of the coordinates, which will hereinafter be referred to as the "center" O—that is to say, if a cross section be made at the center O and another cross section at any other point of the ordinate $y\,y$, then the difference of the areas of these two cross sections is a function of the square of the length of the ordinate between them.

It can be shown analytically that a hyperboloid generated in the manner described is the only solid of revolution that has the geometric characteristic referred to. The physical significance of this is that if the gas channel of a Bunsen burner be constructed in the form of a hyperboloid the speed of any gas passing from the center toward either end under constant pressure will vary from point to point inversely as the square of the distance of the point considered from the center O.

I have found that a Bunsen burner thus constructed, with its relative dimensions proportioned as hereinafter set forth, produces a more perfect self burning mixture of gas and air than the construction of gas burner set forth in my aforesaid Letters Patent, and that this is due to the fact that the increase of speed of the entering gas mixture varies from point to point inversely as the square of the distance from the center O, and that the decrease of speed of the outgoing gas mixture varies from point to point inversely as the square of the distance of such point from the center O. I have also found that the best results are obtained when the angle between the asymptotes of the hyperbola which generates the hyperboloid is about 16°, that the efficiency over and above that of my biconical Bunsen burner shown in my aforesaid patent decreases when this angle is varied, either increased or decreased, and that it vanishes almost entirely when this angle becomes 12° and also when it becomes 20°, so that in order to secure the advantage of my improvement the angle between the asymptotes must be somewhere between the limits of 12° and 20°. Within these limits the gas mixture more nearly approaches that of a perfect self-burning gas mixture than in the case of my former Bunsen burner and attains more nearly perfection the nearer the angle between the asymptotes approaches 16°.

The length of the lower portion of the burner is determined experimentally in the manner set forth in my aforesaid patent, while the length of the upper portion may be varied without departing from my invention. I have, however, found that it is best to make the upper part of the hyperboloid four or five times as long as the diameter of its narrowest section.

The lower portion of the hyperboloid—that is to say, the part which extends from 2 2′ to O—is called the "mixing space," while the upper portion, extending from O to 1 1′, is called the "suction space," the lower portion being designed to cause such a proportional mixture of air and gas as will contain oxygen and hydrogen practically in the proportion of the chemical equivalents of these two gases, while the upper portion is designed to increase the draft of the gas mixture.

In accordance with the principles thus set forth the Bunsen burner portion of my improved incandescent gas burner is constructed as shown in Figs. 2 and 3. The hyperboloidal tube 1 1′ 2 2′ of the dimensions hereinbefore indicated, made of brass or other suitable metal, is formed with the air ports 5 5 and has an external screw thread at 1 1′ and an internal screw thread below the air ports, as indicated. A short tubular casting 6 is screwed into the lower end of the burner tube and is capped, as shown, by a nipple 7, which in this case is indicated as screwed into the tubular section 6. It is, however, evident that the nipple may be formed in one piece with the casting. The nipple projects thus into the Bunsen tube, injecting the gas into the same and mixing with the air entering by the ports. The casting 6 is designed to be connected with the gas supply pipe.

On to the screw threaded portion 1 1 of the Bunsen burner is screwed a dished casting 8, upon which a hollow perforated cone frustum 9 is fitted, and the two are united by another, but non-perforated, cone frustum 10, which screws on to the dished casting and bears with a flange 11, formed near its lower end, upon the flange 12 at the lower

end of the perforated cone frustum. The upper opening of the perforated hollow cone frustum is closed, preferably, by a metallic block 13, which may be biconical, as shown, and flat on its upper end and has there fitted to it a disk 14, serrated around its edge, as shown in Fig. 4, and secured to the block 13 by a screw 15. The disk and its serrations are of such size and all parts are of such height that the upper face of the disk is about flush with the upper edge of the hollow cone frustum 10, but clearing the inner face of the same, so as to leave a narrow annular space between them. This annular space, which is best shown at 16 in Fig. 4, is thus bounded by the circular inner face or of the upper end of the cone frustum 10 and by the serrated edge of the disk 14.

It will be seen from the foregoing description that the gas coming from the supply pipe enters my burner at the casting 6 and discharges into the mixing space of the hyperboloidal tube and there becomes mixed with the air entering by the ports 5. The two gases increase in speed toward the narrowest section of the tube in accordance with the law above set forth and arrive at the narrowest section with their maximum speed and in such proportion as to form a self burning mixture. From that point the gas mixture continues with a speed that diminishes in accordance with the law above set forth and enters the hollow perforated cone frustum 9, which, being closed at the upper end by the block 13, constitutes a mixing chamber, from which the mixture issues by the perforations in its walls into the space bounded by that chamber and the external non perforated, hollow, cone frustum 10, and finally issues through the annular space between the disk 14 and cone frustum 10.

Over the cone frustum 10 is placed the mantle 17 of refractory material, the upper edge of which is fastened to a metallic ring 18, which in turn is hung from a bail 19, and the latter supported by a rod 20, which is secured to any appropriate portion of the burner. Other means than those here shown may be used for stiffening and holding in position the upper end of the mantle.

Within the mixing chamber the gas mixture expands and then again becomes compressed at the perforations in the walls of the cone frustum 9, then again expands within the space between the cone frusta 9 and 10, and again becomes somewhat compressed at the annual space 16, where it is ignited. The alternate expansions and compressions of the gas serve to more thoroughly mix the gases, as will be readily understood. The burning gas mixture, which is self burning, impinges upon the mantle and raises the same to hyperincandescence.

I have found that by making the annular space 16, through which the gas mixture issues from the burner, alternately wider and narrower by the serrations in the edge of the disk 14, the flame with which the gas burns is very much more steady than if the annular space were uniform. The pulsating variations of intensity of light which would otherwise result are entirely avoided by this improvement.

I make the whole structure, with the exception, of course, of the mantle, of materials that are good conductors of heat, and therefore preferably of brass, bronze or copper. The object and the effect of this are to conduct the heat from the serrated disk as quickly as possible, whereby the latter, which otherwise would be easily destroyed by the intense heat of the flame, is maintained at a comparatively low temperature and can be used for a long time without deterioration.

The inventor's claims are :

1. A Bunsen burner having a gas conduit shaped as a hyperboloid that is generated by a hyperbola rotating about its axis of ordinates, substantially as described.

2. A Bunsen burner having a gas conduit shaped as a hyperboloid that is generated by a hyperbola rotating about its axis of ordinates, and the asymptotes of which form an angle of more than 12° and less than 20°, substantially as described.

3. A Bunsen burner having a gas conduit shaped as a hyperboloid that is generated by a hyperbola rotating about its axis of ordinates, and the asymptotes of which form an angle of about 16°, substantially as described.

4. In an incandescent gas burner, an annular gas outlet formed by a disk having a toothed edge and a tube concentrically surrounding the same, the disk being supported by and in good heat conducting relation to a heavy block, the said disk and block being made of a metal that is a good conductor of heat, for maintaining the disk at a moderate temperature, substantially as described.

5. An incandescent gas burner having an annular gas outlet formed by the circular upper edge of the burner and a toothed disk of smaller diameter located within the same, whereby a steady annular flame composed of a continuous succession of thicker and thinner segments is produced, substantially as described.

Notes on Coal Tar and the Preparation of its Products.

[A paper read by Mr. Ernest F. Hooper before the North of England Association of Gas Managers.]

The notes which I have the honor to bring before you to-day, with your permission, I will divide into three sections—firstly, a brief summary of the history of coal tar ; secondly, coal tar and its constituents; thirdly, how its products are prepared.

The history of the manufacture of coal tar products is contemporaneous, as a whole, with that of its sister craft—the gas lighting industry. It would appear, however, according to Dr. G. Lunge, of the Zurich Polytechnicum, in his monumental work on tar distillation, that the heavy tarry bodies produced on heating coal with a limited supply of air were noticed and brought into use long before the pioneer of coal gas—William Murdoch—devised means for using that gas as an illuminant. The coal tar obtained in the manufacture of coke similar in character to that produced in a gas retort was investigated by J. J. Becher in the latter part of the 17th century, and he recommended its use for preserving wood and ropes. Clayton, in 1738, dealt with coal by destructive distillation, and gave notes as to the production of inflammable gases, coke and tarry bodies. Both those men were undoubtedly leading up to the now historical work of the gas pioneers who first put the manufacture of coal gas, as an illuminant, on a practical basis.

In the earlier stages of our allied industries, two facts stood out at once as requiring immediate attention—firstly, that the coal gas must be purified from tarry bodies very considerably before use as an ordinary illuminant; and, secondly, that coal tar thus obtained must in some way be manipulated or altered before its qualities as a paint or preservative could be widely used, coal tar being, at this time, of no commercial value whatever. Hence, at the end of the eighteenth century, and synchronically with the earliest public use of coal gas, steps were taken to boil the tar, first in open vessels and later on in closed boilers, to free it from its then unknown and undesirable acrid and spirituous constituents, which rendered it difficult to use and ill adapted as a varnish or paint.

Between 1768 and 1838 it became apparent to engineers who were using large quantities of timber for construction purposes, and in the later years, when sleepers for the permanent ways of railroads were required, that some measure must be adopted to protect the timber from atmospheric change, the ravages of insects and general deterioration. Numbers of patents were taken out to attain this result, amongst the most important being the following : Kyan, who early in the 18th century introduced the injection of mercuric chloride (corrosive sublimate); Boucherie, in 1768 patented injection of copper sulphate ; Sir. Wm. Burnett, in 1815, patented injection of chloride of zinc ; Paine, later on, injected ferrous sulphate and sulphate of barium ; Bethell, in 1838, introduced the injection of heavy tar oils. The latter system is practically the sole survivor of the various processes devised, and one in very extensive use at the present time. A monograph of great interest has been written on the subject of cresoting, its history and application, by my late chief, Mr. S. B. Boulton, of the firm of Burt, Boulton & Haywood. The paper was read before the Institution of Civil Engineers, and appears in volume 78 (1883-4) of the proceedings of that Society.

The whole question of timber preservation by coal tar oils is one of great importance to engineers, and of the practical value of this process there cannot be two opinions ; but, strangely enough, the theoretical views relative to the usefulness of the constituent bodies are exceedingly divergent, and tar distillers nowadays have to be prepared to fulfil a great variety of specifications. During the earlier years of this century many eminent chemists made the study of coal tar and its products a matter of special research.

Benzene was first eliminated from coal tar in 1845 by A. W. Hoffman. Charles Mansfield first prepared it in quantity in Hoffman's laboratory ; this hydrocarbon was prepared by Faraday in 1825, and by Mitscherlich in 1833, from other sources.

Toluene was first prepared from rosin gas residues by Mitscherlich in 1838, and it was proved to be a constituent of coal tar by Mansfield in 1848.

Xylene was discovered by Cahours in wood naphtha, and recovered from coal tar by Ritthausen and Church. Fittig, in 1869, proved that it consisted of certain isomeric bodies, and Jacobson, in 1877, isolated the three xylenes.

Naphthalene was first discovered by Garden in 1820.

Anthracene was discovered by Dumas and Laurent in 1832, and prepared by Fritsche from coal tar in 1857.

Phenol (carbolic acid) was discovered in 1834 by Runge, and its

preparation from coal tar engaged the attention of many eminent men of science about that time.

Aniline, the parent of the coal tar dyes, was artificially prepared by Unverdorben in 1826, and discovered as a coal tar constituent by Runge in 1834. Aniline, as such, was not, however, found in crude coal tar in quantities sufficient for commercial use. (In experiments I have recently had occasion to make I have obtained, after repeated fractionations of heavy coal tar bases, a complex body containing as much as 30 per cent. of pure aniline.) Runge first obtained brilliant coloring matters by the action of chloride of lime (calcium hypochlorite) on aniline, but it was left to the eminent chemist, Dr. W. H. Perkin, who is happily still with us, to prepare, in 1856, for the first time, coal tar colors of the aniline (mauveine) series on a large scale. In 1859 Verquin prepared aniline red in quantity. Lightfoot discovered aniline black in 1863, and Graebe and Liebermann synthesized alizarine from anthracene in 1868. Eosin dyes were prepared by Baer in 1874, and since then azo dyes, benzidene and diazo dyes have been produced; and in 1880 Baeyer had so far advanced with his work on artificial indigo that the Badische Anilin and Soda Fabrik put on the market a product from which artificial indigo could be produced on the fiber.

From the year 1860 onwards, it may be considered that the manufacture of coal tar products was raised into a distinctly scientific industry: and at the present time we may claim that no applied engineering or chemical skill is too intricate or delicate to be employed in preparing, building up and applying the thousand and one colors, drugs, perfumes and other bodies of general usefulness emanating from coal tar. Of late years, owing to the demand for particular types of bodies, tar distillers have had to devise methods and plant for preparing several bodies in a high state of purity, chief among these being benzene, toluene, the xylenes, phenol and cresol, pyridine, naphthalene and anthracene, the latter product being produced to contain a minimum of 30 per cent. pure anthracene.

Having dealt, in brief, with the general history of coal tar, we will turn our attention to the body itself. At the present time the annual make of coal tar throughout Great Britain seems, from obtainable statistics, to be between 800,000 and 900,000 tons; and judging from the value of products at the present time, we appear to have reached the point where the supply is in excess of the demand.

High heats are undoubtedly the order of the day; consequently the hydrocarbons of the methane (paraffine) series, of which methane (CH_4) is the simplest type, as far as my information goes, are practically unknown in ordinary coal tars, the high heats producing almost exclusively the hydrocarbon compounds rich in carbon, *i. e.*, the aromatic or benzene series. The molecular condensation as the temperature increases carrying with it the separation of hydrogen, higher bodies still, of the naphthalene, phenanthrene, and anthracene types, are produced, the oxygen assisting in the formation of the phenol (carbolic acid) series. A high or low heat in the retort consequently means a considerable difference in the actual analytical contents of the tar, relative to its products. The tendency of late years has been to produce more gas and denser tars, the latter, at times, being almost comparable to pitch itself.

I have endeavored to trace the specific gravity of tars in the earlier days, probably about the time of cast iron retorts, but with little success. It seems, however, that with the use of iron retorts about 6,000 to 6,500 cubic feet of gas would be produced from one ton of Newcastle gas coal. Mr. L. T. Wright has published a series of figures showing that on this basis the specific gravity of the tar would be about 1,086. Later on, with clay retorts and higher temperatures, the specific gravity of the tar rose to 1,120 to 1,150. From further notes I find the specific gravity of tar produced in 1882 averaged from 1,175 to 1,215. In 1888 the specific gravity rose to an average of 1,205, and at the present time the average tar will vary from 1,220 to 1,240. These data point to the fact that more pitch and free carbon are included in the tar year by year, and less oil and lighter products.

An analysis of tars of different gravities may here prove interesting. The first, second and fourth analyses are taken from Mr. L. T. Wright's figures; the third is an average tar at the present time:

	Specific Gravity.			
	1,086	1,140	1,200-1,230	1,206
Crude naphtha	9.17 p. ct.	3.73 p. ct.	1.5 p. ct.	1.00 p. ct.
Light oil	16.50 "	4.47 "	1.3 "	0.57 "
Creosote.....	26.45 "	27.29 "	14.5 "	19.44 "
Anthracene oil.....	20.32 "	18.13 "	16.0 "	12.28 "
Pitch	28.89 "	41.80 "	60.0 "	64.08 "
Gas per ton of coal...	6,600 c. ft.	8,900 c. ft.	10,000 c. ft.	11,700 c. ft.

This assumption is confirmed by a communication made by Mr. Irwin to the Manchester section of the Society of Chemical Industry in February of this year, as he shows that higher temperatures mean less benzene, phenol and xylene, and more naphthalene and pitch, anthracene remaining fairly constant. He also emphasizes the high value of benzene as an enricher, although, as he points out, tests made by the Argand burner—now practically out of use by the public—are less favorable to this enricher than those made with other burners.

I believe it is generally assumed by gas engineers that benzol at or below one shilling per gallon is unequalled as an enricher, and as a solvent for naphthalene, by any other body. As it is considerably below that figure now, and likely to remain so, owing to large production, this matter is worthy of close attention at the present time. The whole question of the enrichment of coal gas for illuminating purposes, and dissolving naphthalene in the mains, has been ably dealt with by Dr. P. Eitner, before the Mid-Rhenish Association of Gas and Water Engineers. An abstract of the paper appears in the *Journal of Gas Lighting* for 2d February, 1899, and is worthy of close perusal. Dr. Eitner adduces proof that the benzene homologues stand at present far above other solvents in value ratio, and that the xylene bodies show the best results of this particular series.

Up to the present time, as far as I can ascertain, there are about 150 to 200 bodies of distinct identity actually present in coal tar. Undoubtedly many more exist, but they have not yet been isolated in a state of sufficient chemical purity to warrant their inclusion in authoritative lists. Many are gaseous, more are liquid, and a large number are solids at ordinary temperatures. The majority, when chemically pure, are white—the oils water-white, and the solids crystalline bodies. [The author exhibited samples of some of the better known bodies prepared in a high degree of purity.] The following are some of the more important:

Name.	Type.	Boiling Point.	Specific Gravity at 0° C.	Formula.
Benzene	liquid	80.5	0.899	C_6H_6
Toluene.....	"	111.0	0.882	C_7H_8
Xylene, ortho..	"	142.5	0.756 at 14° C.	C_8H_{10}
" meta..	"	139.8	0.878	"
" para..	solid	138	0.862 at 19.5° C.	"
Naphthalene ...	"	218.2	1.145 at 4° C.	$C_{10}H_8$
Acenaphthene..	"	265.75	1.03	$C_{10}H_{10}$
Anthracene.....	"	360	1.38	$C_{14}H_{10}$
Phenanthrene..	"	340° C.	—	$C_{14}H_{10}$
Pyrene.....	"	over 360° C.	—	$C_{16}H_{10}$
Chrysene	"	436	—	$C_{18}H_{12}$
Phenol	"	182° C.	1.089	$C_6H_5.OH$
Cresol.....	liquid	182-210	—	C_7H_8O
Benzoic acid...	"	249.2	1.201 at 14° C.	$C_7H_6O_2$
Aniline.....	"	182° C.	1.026	C_6H_7N
Pyridine	"	116.7	0.986	C_5H_5N

Professor Dewar, of the Royal Institution, informs me that he has succeeded in solidifying all the hydrocarbons of the benzene series that have come under his notice up to the present time. It will be of great interest to learn their freezing points.

Having dealt briefly with the history, types, and constituents of coal tar, I will now explain the general methods by which the crude tar is converted into the various products from which subsidiary industries prepare their own specialties for trade purposes. In a large tar works, the crude tar as it arrives, either by pipe, barge, railway tank or barrel, is emptied into a large reservoir constructed either of iron or cement. This induces a blending of the various grades of tar, making a fairly average product to pass into the stills. The larger this store tank the better, as it allows a greater quantity of supernatant ammoniacal liquor to settle on the surface, to be drawn off for use in the sulphate plant. (The total ammoniacal liquor held by the tar in suspension, including the liquor from the stills and tar heaters, amounts to about 5 per cent. of the tar, with an average test of 4° to 5° Twaddel.)

The crude tar to be dealt with day by day is then pumped into a smaller tank or boiler, heated internally by hot air or steam pipes. The tar is raised to such a temperature that most of the remaining liquor will separate and rise to the surface, by reason of its lower specific gravity, but not to such a temperature that any of the lighter bodies will distil off or escape. Thence the hot air is led into iron stills, each of which will generally contain 10 to 15 tons of tar, equivalent in measure to between 2,000 and 3,000 gallons.

The usual design of a still is an upright cylindrical iron or steel shell, built with a convex top and a concave bottom. A cast iron still headpiece for collecting and condensing the distillate is fixed on the top, conducting distillate to the worm. At the back is a run-off pipe for

the pitch. Most stills are fitted with some method of internal agitation, and also steam pipes with jets, to assist in driving over the heavier oils and to prevent the pitch coking on the bottom plates. The agitation is continuous from the time the fires are lighted till the pitch has been run off into the coolers.

The fires are lighted when the stills are full to the requisite level, and, of course, after steam has been blown through the still and worm, to make certain that the pipes and connections are quite free and clear from obstructions. About an hour and a half after the fires are lighted the contents of the still are raised to the point of ebullition, and the crude naphtha and ammoniacal liquor begin to distil over. At this stage a large quantity of cold water must be passed through the condensers to cool the worm, and so allow the light bodies to become condensed sufficiently at the receiving chambers to prevent loss by evaporation. (A considerable quantity of gas is evolved from the tar at this stage, no doubt owing to decomposition occurring.) The first fraction is usually termed 30 per cent. crude naphtha, and tests 30 per cent. by distillation at 120° C.

This first fraction will include the following bodies: Benzene, about 40 per cent.; toluene, 12 per cent.; and xylene; and, in small proportions, thiophene, pyridine bases, carbon bisulphide and phenolic bodies. The specific gravity of this fraction will be about 900 to 920. About 3 to 4 hours suffices to collect this distillate.

(No. 2 naphtha) is generally collected by measure, 100 to 120 gallons for a 3,000-gallon still. This will contain small quantities of benzene, toluene, xylenes and their higher homologues; much naphthalene, and more phenolic bodies than the first running. It has specific gravity about 950 to 1,000. This distillate will run for two to three hours. The No. 2 naphtha will be redistilled in a naphtha still fitted with a small condensing tower, and the lighter distillate obtained run to the 30 per cent. crude naphtha; and the higher boiling point and remaining oils will, in due course, be washed, to extract the phenolic and basic bodies.

Leaving the tar department, the light crude naphtha fraction will be sent to the benzol house, where these oils are washed, first with water, to free them from ammoniacal impurities, then with acid, to extract the basic bodies, as sulphates, and, lastly, with caustic lye or lime to obtain the phenols, as sodium or calcium phenates. The basic or phenolic bodies are then dealt with in their respective departments. The naphtha is further treated with sulphuric acid, water and soda lye, and then run to the benzol still, a wrought iron or steel boiler with a high condensing tower, on the same principle as the Savalle, Coupier or Siemens fractionating columns, as used for the purification of alcohol and such like bodies. The distillate here will then yield 90 per cent. benzol; 90 per cent. distilling at 100° C.; and besides this, lower fractions, *i. e.*, toluol and solvent.

The next fraction collected is termed the carbolic oil run, the specific gravity reaching a little over 1,000. It contains a small quantity of heavy naphtha, much naphthalene and other solid bodies, and about 5 per cent. of phenol crystallizing at 60° F. Pure carbolic acid crystallizes at about 42° C., or 107° F. This fraction, of about 150 gallons, will take about an hour to run from the tar still. The carbolic oil is mixed with the heavier naphtha, already mentioned, from the No. 2 naphtha and washed in the carbolic plant with caustic lye, to collect the tar acids contained in the form of phenates. This body is then treated with sulphuric, hydrochloric, or carbonic acid (the last named as gas, the others as solutions) and decomposed into the sodium salts of the respective acids and the bodies of which phenol is the most important. The remaining oil is then generally distilled by itself, and the lighter fractions retained for heavy naphtha, the residue being run to creosote. These fractions, as well as the next in order (creosote), are always being altered slightly in treatment, according to the commercial value of the products contained therein.

The creosote fraction contains large quantities of naphthalene, the methyl-naphthalenes, and smaller quantities of the cresols and heavier basic bodies, mostly higher in the series than lutidine, which has a boiling point of 140° to 150° C. This portion of the distillate is allowed to cool in large open tanks, and the liquid bodies are drained off and used for creosoting purposes and for illuminating oils in the Lucigen and Wells type of lamps. The naphthalene is then dug out as a yellowish semi-crystalline mass, like raw sugar in appearance, which is then bagged and pressed in hydraulic presses, or dried in a centrifugal machine. This semi-refined naphthalene is then put into a large lead-lined tank, melted, and agitated alternately with sulphuric acid and oxidizing agents, such as Weldon mud or the bichromates, then with water, and lastly, with a caustic lye. Thence it is charged into a naphthalene still, and the pure naphthalene distilled by fire into suitable receptacles. Further processes for the preparation of nitro-naphthalene and naphthols—the former largely used in explosives of a smokeless character, and the latter used as the base of the naphthol colors—are carried out at some works. (Crude naphthalene is also largely used by lampblack manufacturers, for the production of carbon black for printing inks). The running of this fraction takes about an hour, and when a sample, on cooling, sets to a buttery non-crystalline solid, distinct as from a crisp non-greasy body, the last fraction, anthracene oil, commences to run. At this point the fires are allowed to slacken, and steam at about 40 pounds pressure is injected into the still. The anthracene fraction takes some five hours to distil over. This distillate has a greenish color, and a density of over 1,050, and on cooling deposits an orange yellow crystalline mass of crude anthracene. This oily paste is passed through filter presses and either bagged and pressed in hydraulic presses and ground, or dried by centrifugal means. The dry crystals are then ready for export, providing they contain not less than 30 per cent. of pure anthracene (by Meister, Lucius and Bruning's test). Otherwise the poorer salts are washed with naphtha or creosote to bring them up to this standard of purity. The heavy oils are refiltered, and are then ready for export for grease-making purposes. The anthracene is well known as the base from which the artificial alizarine colors are all prepared.

The residue left in the still amounts to 55 to 60 per cent. of the tar distilled. This body is known as pitch. It is run off into airtight coolers at the back of the still, this precaution being necessary owing to the fact that the pitch, as run off from the still, has such a high temperature that it would very probably ignite if brought at once into contact with the atmosphere. In these coolers oil is added to make the pitch of the required consistence. From the pitch coolers the pitch is run into large beds lined with cement, wood, or duff coal, on which each day's make is run, raising the bed from half an inch to 3 inches per diem. An alternate plan is to run the pitch into iron pans, from which, each day, the solid pitch is hacked out and stacked, ready for use in various directions, as an agglomerant for patent fuel, in road grouting, and in the manufacture of black varnish, asphalt, etc.

The notes which this paper contains, I should here mention, deal entirely with tar such as is produced from gas coal won in the northeastern district. The tar as obtained from Scotch, West country, or Midland coal, is altogether of a different character to that which I have described to-day; and I believe it would be of great interest to all of us if, on some occasion in the near future, a member of one of our Western Associations would favor our society with a brief *resumé* of results, methods and statistics relative to the West country or Midland tars. In conclusion, let me thank you for the opportunity you have given me to add any small quota of technical knowledge that I have been able to lay before you to the literature of the Gas Managers' Association whose welfare we have so much at heart.

Wind Pressure on Buildings and Other Structures.

[A paper read by MR. J. O. V. IRMINGER, of Copenhagen, at the last meeting of the English Institution of Gas Engineers.]

In a general way the pressure of the wind is expressed in the force exerted on square feet of surface; the surface in question being assumed to be vertical to the direction of the wind. This pressure is expressed as the normal pressure. If the surface acted upon is at an angle to the direction of the wind, various well known formulæ may be employed, several of which have been independently verified. Table I. gives these well known formulæ, where the pressure is calculated according to the angle, and where P is the normal pressure.

Many experiments have been made to verify these formulæ, and especially mentioned is Professor Langley, of America, who has devoted much time to the work. He employed a surface of 1 square foot turning on a radius of 30 feet. This surface could be fixed at any angle, and the pressure was measured by a spring. The apparatus had, however, drawbacks, as the air was seldom quite still, and the surface of the apparatus warped; but he found that with 5° the pressure on the surface was 0.15 of the normal pressure, with 10° = 0.30, and with 45° = 0.93.

The results coincide fairly well with the stated formulæ, but give a much higher value to the first $\sin^2 \infty$, often quoted in the technical handbooks. These high pressures at small angles were completely confirmed, which before the experiments of Professor Langley were a matter of speculation. Pressures on different forms of bodies were not included in Professor Langley's experiments.

Among other later experimenters, Professor Kernot, of Australia, must be mentioned. He employed for his experiments artificial wind, produced by the aid of a small propeller fixed in a wooden box 10 inches

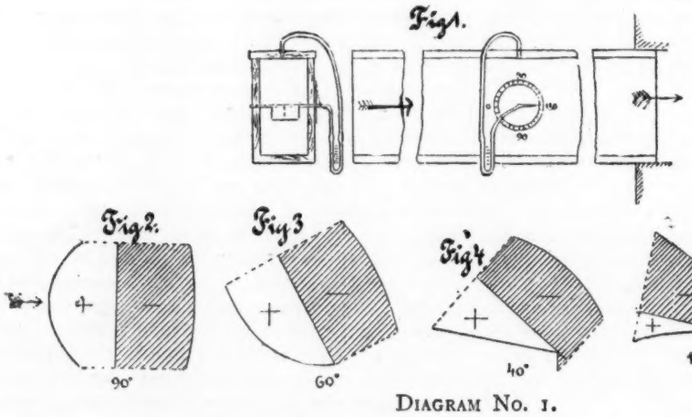


DIAGRAM NO. 1.

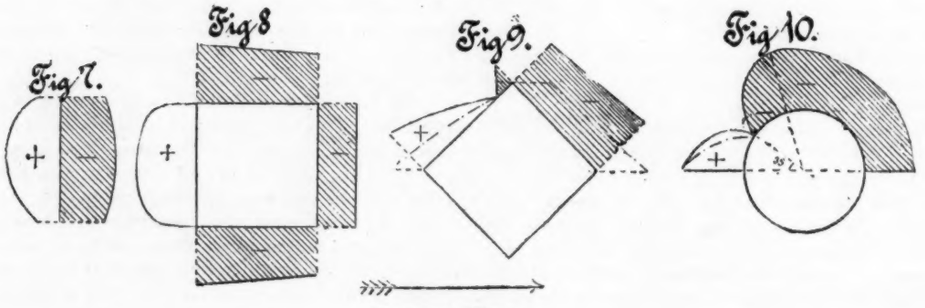


DIAGRAM NO. 2.

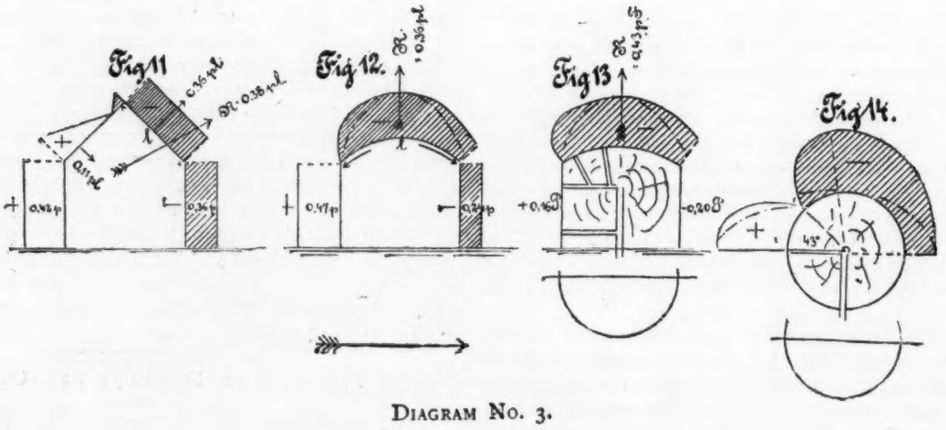


DIAGRAM NO. 3.

TABLE NO. I.

Degrees.	$P_a = P \sin^2 a$.	Lossl. $P_a = P \sin a$.	Hutton. $P_a = \frac{P \sin a}{1{\cdot}84 \cos a}$.	Duchemin. $P_a = \frac{2 \sin a}{1 + \sin^2 a} p$	Rayleigh and Gerlach. $P_a = \frac{p(4+\pi)\sin a}{4 + \pi \sin a}$	Langley. $\frac{P_a}{P}$	Writer's Experiments. Long Planes.		Writer's Experiments. Short Planes.	
							$\frac{P_a}{P}$.	Suction.	$\frac{P_a}{P}$	Suction.
								Per Cent.		Per Cent
5	0·008	0·087	0·131	0·17	0·146	0·15	0·23	100	0·12	100
10	0·030	0·174	0·241	0·34	0·273	0·30	0·45	87	0 26	100
15	0·057	0·259	0·350	0·48	0·384	0·46	0·47	85	0·41	100
20	0·117	0·342	0·457	0·61	0·481	0·60	0·48	83	0·52	94
30	0·250	0·500	0·663	0·80	0·641	0·78	0·60	75	0·65	83
40	0·413	0·643	0·834	0·9	0·763	0·89	0·75	67	0 74	74
50	0·587	0·766	0·952	..	0·854	..	0·84	65	0·82	66
60	0·750	0·866	1·012	..	0·920	..	0·90	63	0·90	56
70	0·883	0·94c	1 023	..	0·965	..	0·95	62	0·95	51
80	0·970	0·985	1·011	..	0·991	..	0·98	59	0·98	47
90	1·000	1·000	1·000	..	1·000	..	1·00	57	1 00	45

by 12 inches; and the pressure was exerted on small objects such as cubes, cylinders, etc., fixed in this box—the results being measured by a delicate spiral spring. He expressed his results in proportion to the pressure exerted on a vertical section of the object experimented on. Later the writer will return to these researches.

All these experiments give the sum of the total pressures, but do not seek to analyze this sum—for instance, the tension of the air on the different portions of the planes and bodies. Generally speaking, the subject has not been a favorite one, and the data on the matter have been of a meager kind; at any rate, it was only the *pressure on the wind side*, especially at small angles, that was experimented on—the part played by suction being little known.

Herr H. C. Voght, of Copenhagen, demonstrated some years ago, before Professor Langley's experiments were published, in several *brochures*, that the pressure on a plane at a small angle was very great; and he discovered the reason to be that on the lee side of the plane there existed a strong tendency to a vacuum, and that this partial vacuum or attenuation of the air was equal to 90 to 95 per cent. of the

power exerted. Although his arguments were so convincing, his theory found little support; and, in fact, there were many who were positively skeptical.

As this question interested the writer in no small degree, he determined to carry the experiments further; and as it was soon evident that the results of importance were within reach, the research was continued with specially constructed apparatus. It is the writer's hope that a recapitulation of these results may not be without interest to those who have not had the opportunity of previously studying the subject.

To study the pressures and vacuum exerted on a plane, such a plane was constructed of tin having a flat surface, but hollow. The interior or hollow room was placed in connection with a delicate pressure gauge, and on the flat surface a little hole was bored so that the outer surface with the hole was likewise in connection with the gauge. By presenting the hole to an air current, it was possible to establish the presence of a pressure if the aperture was in the direction of the wind, and a vacuum when the aperture was in the contrary direction; but at the same time it was evident that no reliable results were obtainable, as the strength of the wind was so variable.

To arrive at definite results it was therefore necessary to create artificial draught, and this was done by employing a chimney shaft 100 feet high, which was in connection with the retort benches, and which gave about ¾ inch vacuum at the base. In calm weather the suction was constant, which was first carefully ascertained. In this manner it was possible to experiment with a powerful draught, but the bodies experimented on were naturally of limited dimensions; at the same time it is a well-known fact that the same laws apply equally to small as well as to larger bodies.

The apparatus used, and which is shown on Diagram No. 1, Fig. 1, consisted of a smooth wooden box 9 inches by 4½ inches, fixed at the base of the chimney. In this box the bodies to be experimented on were placed—for instance, a flat plane. This was of tin, hollow, and perforated with three holes—two at the outer edges and one in the center. This plane revolves on a central axis, likewise hollow, closed at one end, but in connection with the internal hollow of the plane. The open end was connected to a pressure gauge. It was now only necessary to find a zero, or the atmosphere's tension; and for this purpose a hole was made in the box, exactly over the body to be experimented on. In the hole a tube was fixed, projecting not quite through the lid of the box, and connected with the second arm of the pressure gauge. By these means the variations of tension in the box itself and the interior of the hollow plane were ascertainable.

To find the tension in various positions, an indicator and scale was attached to the central axis outside the box. The draught to which the apparatus was to be subjected could be regulated by a valve, attached to the end of the box, the position of this valve being constant under each separate experiment. The normal pressure—*i. e.*, the pressure on a plane at right angles to the direction of the wind—was ascertained by turning the plane with the holes towards the wind, and observing the pressure, and then turning the plane 180°, so that the holes were on the lee side. The resultant sum of this ascertained pressure and vacuum was considered the normal pressure.

It was now apparent that when the pressure—taking, for instance, a single experiment—is about 0.45 inch of water on the front side, the suction of vacuum at the back is 0.62 inch, and the normal pressure 1.07 inches, which represents 5.8 pounds per square foot, or equal to a calculated wind speed of 50 feet per second. There were, as previously mentioned, three holes in the plane. These were experimented on, when the average pressure was ascertained. The holes were now successively shut by sticking-plaster.

As the result of many trials, it was evident that the suction power or vacuum was equal to 57 per cent. of the total pressure or power exerted; but for shorter planes, with air on all four sides, 45 per cent., which is demonstrated on Diagram No. 1 (Fig. 2), where the pressures are shown by the heights of the water column in the gauge.

If experiments be now made on the plane at varying angles—say, 0°, 5°, 10°, etc. (Figs. 3-6)—at 0° suction is evident over the whole surface of the plane. At 5°, on the weather side *nil;* on the lee side, suction is greatest nearest the edge towards the wind. At an angle of 10°, it is ascertained that the pressure on the wind side is greatest first at the *fore edge*, while the suction on the lee side increases.

The writer found on those planes filling the width of the box—viz., extremely *long* planes, with 5° complete suction—at 10°, 87 per cent., and at 90° 57 per cent. suction. With *short* planes, at 15° complete suction, at 20° 94 per cent., at 90° 45 per cent. One can thus ascertain the pressure on the planes by adding the observed water column heights, and the given pressure in proportion to the normal pressure. The results are given Table I.

It is thus apparent that the ascertained results compare well with Langley's experiments, and equally well with the majority of the previously ascertained formulæ, especially with Rayleigh's and Gerlach's. Professor Cederblom, of Stockholm, has recently conducted some experiments with pressures on planes turned towards the wind, inasmuch as he employed a very finely graduated and sensitive pressure gauge connected with the holes in the plane. He used natural wind, and ascertained exactly the same pressure and suction as tabulated previously. Professor La Cour, in Denmark, has likewise recently conducted some exhaustive experiments on windmills, and has verified the tabulated results. The writer has reason to believe that the method of his experiments is correct, and that the size of the planes experimented on plays no appreciable part. What, however, is very evident is the part played by *suction*, especially on planes at small angles.

Experiments were further carried out on various elements, hollow and constructed of tin; but later, for the sake of lightness, of wood bored out—for instance, a sphere, as shown in Fig. 14 on Diagram No. 3 (sphere). The results are shown in Table II., where the pressure on the wind's direction is expressed by d and p. It is thus ascertainable what power is due to pressure and what to vacuum.

The writer desires to shortly sum up the results of the most characteristic experiments, and draws attention to Diagram No. 2, where the amount of pressure and suction is expressed in measured water column heights. The full lines express the normal pressure on the surface, the dotted lines the pressure in the direction of the wind. These are found by resolving the pressure into two powers—a vertical (not taken into consideration) and a horizontal one. Taking, for instance, a *long prism* (Fig. 8 on Diagram No. 2), pressure is found on the front, and suction on the three remaining sides. The pressure is 95 per cent. of the pressure in a plane of the size of the cross section of this body; the suction equals 43 per cent. If the *point* of the prism be presented towards the wind, the pressure only equals 0.79 per cent. (Fig. 9).

Cylinder.—This cylinder (Fig. 10) presents some extraordinary conditions, inasmuch as there is pressure up to 35°, the rest being suction—the maximum being 70°. Resolving likewise the powers in the wind's direction, the dotted lines are obtained, which show the pressures and suction; the total pressure being 0.57, suction 72. Experimenting on a *prism of rhomboidal form*, the total pressure is 0.25, of which suction is represented by 82. This three-sided prism is shown in three different positions. (See Table II.)

On the sphere (Diagram No. 3, Fig. 14) the pressure is found by turning on a lathe a wooden ball, and boring channels for connecting it to the pressure gauge. It is then revolved gradually on its axis, and similar effects are found to those on a cylinder—viz., pressure up to 43°; the balance being suction. As the conditions of pressure are alike at the same distance from the axis, one can estimate the volume of the body, depicted by the dotted lines which show the horizontal powers; and one finds the total pressure to be 0.31 of the pressure on the great circle.

Under the same conditions, experiments were made on *short elements*, such as dice, cylinders, cones, pyramids, etc.; the results being given in Table II.

TABLE II.

Long Bodies.	p = pressure on Square Unit.	Pressure per cent. Wind Side.	Suction per cent. Lee Side.	Short Bodies.	p = pressure on Square Unit.	Pressure per cent. Wind side.	Suction per cent. Lee Side.
—→	$1{\cdot}00\ p\,d$	45	55	—→	$0{\cdot}31\ p\frac{\pi d^2}{4}$	23	77
Prism	$0{\cdot}95\ p\,d$	57	43		$0{\cdot}08\ p\frac{\pi d^2}{4}$	7	93
"	$0{\cdot}79\ p\,d$	21	76	Cube	$0{\cdot}80\ p\,d^2$	78	22
Cylinder	$0{\cdot}57\ p\,d$	23	72	"	$0{\cdot}66\ p\,d^2$	45	55
	$0{\cdot}25\ p\,d$	18	82	Cylinder	$0{\cdot}47\ p\,d^2$	50	50
	$0{\cdot}59\ p\,d$	58	42	Pyramid	$0{\cdot}78\ p\frac{d^2}{2}$	63	37
	$0{\cdot}71\ p\,d$	63	37	"	$0{\cdot}55\ p\frac{d^2}{2}$	45	55
	$0{\cdot}42\ p\,d$	14	86	Cone	$0{\cdot}38\ p\frac{d^2}{2}$	50	50

The results of experiments on the cylinder give the smaller number, 0.47; on a pointed element ⊃ only 0.08, of which suction = 93 per cent.

For comparison's sake, it may be noted that—

Professor Kernot found—		The writer—	
For cubes.....	0.90	For cubes.....	0.80
" cylinders and cones.	0.50	" cylinders.....	0.47
" cones.....	0.36	" cones.....	0.38
		" "	0.81

It is evident that the results agree fairly well, especially when it is taken into consideration that two distinct methods of experimenting were employed.

These sucking actions on flat surfaces parallel with the direction of the wind are remarkable; but experiments easily establish the facts. For instance, by taking two pieces of paper, holding them parallel to each other, and blowing between them, they are drawn together.

On spheres, the sucking action was evident on all the sides the wind passed. It was thus easy to explain why a light ball could be held suspended in a vertical air stream, because the stream was creating a vacuum around the ball. An umbrella ascends vertically when released in a storm, etc. By the same reasoning, the trick of blowing an egg from one cup to another is explained.

It is now of interest to obtain the result of these conditions applied to buildings; and the writer has therefore conducted some experiments with models. (See Diagram No. 3.) The one is a model of a house with an ordinary roof, the other with a semicircular roof. With the first (Fig. 11), the results were precisely the same as those obtained from a prism—*i. e.*, pressure on the wind side, diminishing in an upward direction, and suction on the lee side. Adding together these powers, a result is found in an inclined upward direction per square unit = 0.38 × wind's normal pressure. On the other building (Fig. 12) the result was the same as with the cylinder, *i. e.*, a suction on the whole of the roof surface, and a resultant directly upwards per square unit = 0.36 × wind's normal pressure.

Further, experiments were made on a round building, with a curved roof similar to a gasholder (Fig. B), channels for connection with pressure gauge were bored in the model, as shown on the drawing, the result being a pressure on the side = 0.36 × wind's normal pressure on the cross section, but on the crown a suction in a vertical direction per square unit = 0.43 × normal pressure. On the sides the distribution of pressure is the same as on the sides of the cylinder, and on the roof or crown the same as on the upper roof of the sphere previously referred to. The roof on such buildings has thus a tendency to be lifted into the air in a storm when the weight is insufficient or the roof is insufficiently tied to resist this tendency. The experiment on a gasholder can be amplified by suspending a little gasholder model at one end of a lever arm, and submerging the same in a basin of water, so that only the roof of the holder is above the water. If one blows on the roof with a bellows, the holder will lift itself from the water, and the pressure in the same be reduced.

It is of further interest to inquire if these experiments have direct relations to what passes on a larger scale, when buildings are subjected to a heavy storm. It may be remarked that one often hears of roofs being lifted and carried away by storms. It is of not frequent occurrence in Europe; and if such an event does happen it is usually with light roofs. It is likewise established that it is generally the lee side which suffers, inasmuch as it is *sucked* away. The writer has made observations on roofs during a storm, by boring some small holes in the slates, which holes have been put in connection with a pressure gauge; and the pressure and suction conditions established by experiments were clearly present, varying with the wind's strength.

With a gasholder, the experiment was likewise made during a storm to connect the outlet pipe with a self-registering pressure gauge. The holder contained 2 million cubic feet, and was 170 feet in diameter and 90 feet high. During an exceptionally heavy storm, on the 30th of March, 1887, the pressure in the holder sank from 6.25 to 5.83 inches, or 0.42 inch; varying continually with the strength of the wind. The holder was quite full, and gave in calm weather 6.25 inches pressure. This 0.42 inch is equal to a lifting force of 2.1 pounds per square foot, or 44,000 pounds on the total surface of the roof. Applying the formulæ found by experiments, 2.1 = 0.43, or $p = 4.9$ pounds per square foot, which represents the wind's most powerful impact on the roof of the holder. The pressure on the side of the holder was 0.36 × 4.9 × 15,000 = 26,600 pounds, of which 11,800 pounds was the pressure on the wind side and 14,800 pounds suction on the lee side.

Referring to information obtained from the Meteorological Institute in Copenhagen, where the wind is measured with a self-registering pressure gauge, the wind varied on the occasion named from 29 to 70 feet per second. This pressure appears to be very low, but in reality the wind pressure on a large surface is never so great as estimated, on account of the irregularity of the wind's speed.

The variation has been especially studied by Professors Langley and Marvin, of America, and it has been demonstrated that, even on high places, lying unsheltered, the wind varied incessantly. Professor Langley noted variations of 9 to 36 miles per hour, and ascertained that, taking the average of the maximum and minimum variations, the speed varied 10 miles each to 10 seconds. The speed would suddenly vary from 40 miles an hour to 0; but there were innumerable variations. Professor Marvin discovered similar variations, and at the Copenhagen Meteorological Institute (where the wind speed is measured by current passing over an open vertical pipe, in which the contained liquid is raised by the rarefaction or suction caused by passage of the wind) results of a like nature were observable.

Sir J. Wolfe Barry, the Engineer of the Tower Bridge, read a paper last year before the British Association, in which he explained that, after the destruction of the Tay Bridge, the Board of Trade issued instructions to the effect that all future calculations were to be made on a basis of a pressure of 56 pounds to the square foot, instead of the 40 pounds as previously calculated, and he further remarked: "I have been able to carry experiments further at the Tower Bridge by observing the pressure on the surface of the bascules of the bridge, as evidenced by the power exerted by the actuating engines. In this case we have a wind gauge of some 5,000 feet in area, and it has been shown that, while small anemometers placed on the fixed part of the bridge register from 6 pounds to 9 pounds per square foot, the wind pressure on the bascules is only from about 1 pound to 1½ pound per square foot. It is difficult to imagine the amount of money which has been wasted in unnecessary provision against wind strains of 56 pounds on large areas, in consequence of this hurried generalization of insufficient data. I know something of what the provision of 56 pounds on the square foot for wind cost at the Tower Bridge, and I do not wish to mention it. But if the public had been told that the dictum of experts, arrived at however hastily in 1880, was to be set aside in the construction of that bridge, all confidence would have been destroyed in it beforehand, and I suppose no Committee of Parliament would have passed the Act." Here the pressure per square foot is even less than that ascertained by the writer during a storm, viz., 4.9 pounds per square foot, perhaps on account of the area of the gasholder being three times as large.

The writer once, under a storm, tied with a thin cord a large gasholder, 120 feet in diameter, fast to a column on the wind side. The cord held for half an hour and eventually broke. It was confirmed, by testing the breaking strength of the cord, that the wind pressure was only 3 pounds per foot. A communication on this subject was sent to the *Journal of Gas Lighting* for May 4, 1897.

If one really wishes to become acquainted with the force of the wind America is the place to visit. Mr. J. Baier, an American Engineer, has published the results of some inquiries on wind pressures in the "Proceedings" of the American Society of Civil Engineers for January, 1897. These statistics are voluminous, and are accompanied by many photographs which depict ruined structures which have the appearance of having been submitted to the effects of fearful earthquakes. The writer will dwell shortly on several of the items which are of special interest, and which are closely allied to the subject under discussion.

A tornado demolished, in the course of half an hour, something like 7,263 buildings, of which number 321 were totally razed to the ground. At the same time the new large St. Louis iron railway bridge was ruined, 252 lives were sacrificed, and the monetary loss amounted to £3,000,000 sterling. The buildings for the major part were built of iron and stone. To quote an instance of the storm's severity, it can be mentioned that the railway bridge was ruined by the wind lifting a portion of the track, weighing 280 tons, quite away, at the same time demolishing the brickwork. Enormous steel beams, weighing 13,000 pounds, were flung 120 feet away. The railing of the bridge flew 1,300 feet from its original position; and it was proved that the wind exerted a lifting force on the roadway of the bridge of 43 pounds per square foot. The loosened portions of the bridge were hurled through the air similar to projectiles; one wood plank being thrust through an iron plate $\frac{1}{16}$ inch thick. A large corn elevator, of wood, weighing 3,500 tons, was removed 19 feet and crushed. Another even heavier elevator was pushed 11 inches to one side, but again blown back. This is enough to show the appalling power that had been raging.

The storm exerted its force mostly on the upper storeys, where the roofs were lifted off and blown away, with the consequence that the walls collapsed. It was estimated that the wind force equalled 120 miles per hour—about double the speed known in Europe, and equal to

four times the force. The upper storey of the Meteorological Institute was blown away, and many of the instruments followed suit; but, with true American energy, the observations were continued as well as possible under the existing conditions on the lower floors. Mr. Baier found that, on estimating the stability of the structures, the force exerted on and in the destruction of the St. Louis bridge must have been 60 pounds on the square foot, and the power which removed the corn elevators 40 pounds on the square foot. Such a hurricane simply razes all and everything in its path, but is fortunately not known in Europe; and if we assume that the forces mentioned by Mr. Baier are correct, it cannot be wondered at that those estimated in Europe are considerably less violent.

Mr. Baier has further inquired into the reasons for these tremendous effects of storm, and is convinced that a great portion of the destruction is due to the constant variation in the speed and strength of the wind, by which great differences in pressures are established in the interior and exterior of buildings, which pressures have no time for adjusting themselves in a natural manner, but break through windows and walls, seeking equlibrium by the shortest way possible. A considerable portion of the damage is likewise due to the previously explained *suction* on the lee side of buildings and structures. Mr. Baier goes deeply into these matters, and the results have been published in America. He mentions that unexpected results have been arrived at, especially regarding the powers of suction, which may thus be looked upon as a known phenomenon. When the wind has a speed of 90 miles and a variation of 120 to 160 miles, it will, according to experiments, when it rushes across a building, exert a lifting force of 20 pounds to 40 pounds per square foot, without giving the pressure time to adjust itself. Finally, Mr. Baier says: "The results of these experiments show that the wind acts in a direction quite different from that generally assumed, and usually provided for in designing bridges, roofs and buildings." The evidence of St. Louis confirms this conclusion.

One may thus assume that the experiments on the small models have been verified by Nature herself, and that calculations of the wind's force must be made on a different basis from that hitherto taken, inas much as, besides the horizontal effects, the upward force must be taken into consideration, the power of which can equal half the power of the wind's normal pressure.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, May 10, 1899.

The Antiseptic Gas Flame.—A Relic of the Deposit System.—A Pennyworth of Gas.—The Institution of Gas Engineers.—Death of Mr. Frank Livesey.

Having repeatedly taken exception to the statement so frequently advanced by persons interested in electricity supply, to the effect that the use of gas in a room means a more or less poisonous atmosphere, and the substitution of electric light for the gas at once secures a pure and wholesome atmosphere, it is with particular satisfaction that I notice some remarks in a medical journal called the *Hospital*, on the purifying influence of naked lights. The medical profession in this country, as a rule, are prejudiced in favor of electricity, but, from one or two copies of the *Hospital*, that have at different times come into my hands, it appears that the editors of that journal have managed to escape the attack of electricity fever, and are prepared to discuss questions relating to gas and ventilation in an independent manner with reference to observed facts, rather than to opinions put forth in the usual more or less loose and inaccurate manner. Some years ago a shrewd, practical gas man created much amusement by claiming that a gas flame exercised a wholesome antiseptic influence that was not without effect upon the public health in large towns. The ridicule excited by this statement was evidently unmerited, for the *Hospital* says that "notwithstanding the advantage of the electric light, the loss of the purifying effect of the open flame has always been recognized by some sanitarians as a distinct evil. No doubt the vitiation of the air by gas or oil lamps is an evil, but it has this countervailing advantage that the obvious heat and oppressiveness so produced lead of necessity to ventilation, whereas in a room lighted by electricity there is nothing to compel ventilation until the air is rendered more or less fetid by accumulated animal exhalations. But besides compelling ventilation, the open flame has a great purifying influence, in that it actually burns up all the organic dust which passes through it, and the amount of air which passes through a gas flame in the course of an hour is considerable. * * * Our gas flames and oil lamps, though they use up some oxygen in the process, act as germ destroyers." This is simply a corroboration of what every careful observer must have noticed at times. In the electrically lighted room it is possible, according to this authority, for the air to become "more or less fetid," but in the gas lighted room there is no risk of such an undesirable condition. The heat of combustion is a useful aid to ventilation, promoting that upward current—*i. e.*, the fresh air entering at the floor and the foul air escaping at the ceiling—which is regarded by reliable authorities as the proper method. In most cases, if proper inlets and outlets are provided, the gas flame will do the rest. But the electric lamp is absolutely neutral, and even if the filament was naked, so that air could pass in contact to it, there would not be heat enough to create a decided current. The gas flame creates annoyance in a badly ventilated room, but under proper conditions is as innocuous as electricity. It is a case similar to that of gas finding its way from the subsoil of the street to a neighboring house, by way of the drains. If the coal gas can get into the house in this way, so can all the abominations and infection from the sewer gas. And if the occupant of a room is forced to breathe an atmosphere charged with the products of combustion, he must also take at the same time a dose of the accumulated animal exhalations. If the drains are sound the gas cannot escape, and if the ventilation is good, the occupants will get a supply of fresh air and not stale.

A remarkable example of the deposit system, once the general practice with gas companies, but now almost entirely abandoned (for the reason that a party who has paid a deposit is never disposed to be prompt in settling the account when rendered, and practically more than takes out its value) came before one of the London County Courts a few days ago. The Gas Light and Coke Company sued a consumer for a balance of £1 due for gas. The consumer admitted the claim, but also made one on the Company for a similar amount, being a deposit paid to the predecessors of the Gas Company 39 years ago. In 1860 he applied to the Imperial Gas Company for a supply of gas, and was compelled to pay a sum of £1 as security. In 1876 the Imperial Company amalgamated with and was merged into the Gas Light and Coke Company. They could produce no books or documents bearing upon the transaction, but the consumer produced a cash book containing the entry of a payment of £1 as security. The Gas Company alleged that the payment was a fee intended to cover the cost of the service pipe, but the Court accepted the evidence of the cash book and gave judgment against the Company's ordering that the £1 should be repaid with costs. Perhaps this was a kind of test case, brought for the purpose of obtaining a ruling. Most companies would simply have paid the £1 out of the petty cash box, but it is the rule with the Gas Light and Coke Company, I am told, to admit no liability whatever. Possibly with the large business under their control this is the only safe course to pursue, and any sign of compromising for the sake of peace, would encourage attempts at blackmailing.

Mr. John Young, the Manager of the Norwich Gas Works, made a lucky hit in opening a local exhibition of gas appliances, by telling his audience the value of a pennyworth of gas, or what any consumer could receive in return for the insertion of a penny into a slot meter. The general public no not care for plain statistics, but will appreciate fancy ones. They will not listen to plain figures, but bring in a reference to the number of men required, joined hand to hand, to reach from here to the moon, or the number of sovereigns placed edge to edge that would cover a line 100 miles long, and their attention is secured. Using an ordinary flat flame burner, Mr. Young said that the penny would secure a light equal to 16 candles for 6 hours, and by adopting an incandescent burner three times as much light would be afforded for 8½ hours. This, by-the-way, is equivalent to about 1½ times the light usually claimed by electricians as furnished by a unit of electricity, but Mr. Young wisely avoided comparisons of this sort. With a properly constructed gas fire the pennyworth of gas would heat a large room for 1½ hours. Consumed in a cooking stove, it would cook a four-course dinner for six persons. It could also be applied to heat sufficient water for two baths in 15 minutes, or by means of a gas engine, to yield 1-horse power for 1½ hours. These facts should appeal to the large class who believe in not paying twopence for the article that can be secured for a penny. It is stated that at Norwich 700 cottages have been fitted with slot meters, and 1,550 gas stoves, and 350 gas fires fitted up within the last twelve months, which is a highly satisfactory showing. Even where the sales are already high it is invariably found that a large increase of business will follow a wisely liberal and enterprising policy.

The annual meeting of the Institution of Gas Engineers was held in

London last week. The international tone which has been a feature of this Association during the last few years was well maintained by the President, Mr. F. D. Marshall, Engineer to the Danish Gas Company, whose headquarters are at Copenhagen, who delivered an address that may be described as "characteristic" in the fullest sense of the word. Of Mr. Marshall it has been well and truly observed "that in spite of all temptations to belong to other nations, he remains an Englishman." But having been a resident in a foreign land for some years, and conducting a gas undertaking under circumstances very different to those which obtain in this country, he was able to impart into his address a pleasing variety and freshness, which cannot be said of all the papers read. Apart from the interesting paper read by Mr. Irminger, Engineer of the Copenhagen Gas Company, and the lecture by Prof. Lewes, the programme was somewhat thin, and many of its numbers bore the unmistakable stamp of being prepared to order. The authors are to be commiserated with rather than blamed for this state of affairs, for the plain fact is that the gas industry does not furnish sufficient material to admit of some dozen Presidential addresses and five times that number of papers being prepared every year without some degree of repetition or dullness.

A striking personality has always some fresh light to show upon the most hackneyed subject, of which no better case in point could be quoted than the address delivered by Mr. Marshall. And there are frequently peculiar local circumstances that can be dealt with in a taking or novel way, such as where special processes or arrangements have to be devised for meeting special conditions. Some gentlemen have made a particular hobby of one particular department, and it is always interesting if this sort of character can be induced to leave his shell—usually a difficult process—and come forward with an account of his researches or experiments. Failing these, it seems a pity to waste time hearing, or attempting to get up a discussion upon, a paper that is a worthy attempt as an essay or literary production for including in the published proceedings, and that may be perused with interest and profit, but which possesses none of the elements which go to make up a "taking" paper. I do not propose to enter upon a discussion of the numerous novel ideas introduced into the Presidential address. Prof. Lewes dealt with "Incandescent Mantles" in his usual inimitable style, and Mr. Irminger's paper was a masterly pronouncement on "Wind Pressures on Buildings and Other Structures," a subject on which the writer is a known authority.

A heavy cloud was cast over the Company by the arrival of the news of the death of Mr. Frank Livesey. The deceased gentleman is not so widely known as his brother, the Chairman of the South Metropolitan Gas Company, but was respected by a wide circle of friends and by the whole of the South Metropolitan staff, as a good master, a kind hearted and unassuming man, and an energetic and progressive gas engineer. After acting as assistant to Mr. George Livesey for 10 years, he succeeded him 17 years ago, as Chief Engineer of the South Metropolitan Gas Company. The news of his death at the comparatively early age of 55 was received with great regret. Mr. Frank Livesey is entitled to the chief share of the credit attached to the designing of the 12 million gasholder at East Greenwich, the largest and the cheapest (in regard to capacity) gasholder in the world. Nor was his work confined to gasholders. He followed keenly the whole details of retort house and purifier house work, and he might truly be called the Goldsmith of gas engineering, as he touched nothing that he did not adorn. Notwithstanding his onerous duties, he was always at the service of anyone wanting information, and on more than one occasion I have, in response to inquiries, met with a kindly reception at Old Kent Road.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Proprietors of the Logan Iron Works, Brooklyn, N. Y., have been awarded a contract for the construction of a gasholder, of a capacity of 100,000 cubic feet, on the site of the gas works which will be erected this summer at Lakewood, N. J. The contract also calls for the furnishing of some of the smaller apparatus. It is thought that the Lakewood works will be completed by Sept. 1.

THE proprietors of the Laclede Gas Light Company have declared the regular semi-annual dividend of 2½ per cent. on the preferred stock, payable the 15th prox.

THE United Gas Improvement Company is under contract to remodel the works of the London (Ohio) Gas Light Company. The contractors will install a set of their standard, double-superheater Lowe water gas apparatus, of a daily capacity of 125,000 cubic feet; also purifiers and storage oil tank.

THE Directors of the Alexandria (Va.) Gas Company have ordered a reduction in the selling rate of 15 cents per 1,000 cubic feet—from $1.40 to $1.25 per 1,000. The concession is to date from June 1.

MR. L. M. RUMSEY, of St. Louis, Mo., has purchased the franchise and real property of the Lexington (Mo.) Gas Light Company.

THE local press of Santa Clara, Cal., favor the construction there of a gas works to be operated on municipal account.

THE following circulars respecting the failure of the proposed refinancing of the Washington (D. C.) Gas Light Company explain themselves:

PHILADELPHIA, May 16, 1899.

To the depositing stockholders of the Washington Gas Light Company, Washington, D. C.—On the 24th of April, 1899, a circular was addressed to you in reference to the deposit of your stock with the Fourth Street National Bank, for the purpose contemplated in the agreement referred to in that circular. Under the agreement the power was reserved to Mr. Gorman, the proposed purchaser, to take the stock at $60 per share, or to decline to take it if he saw fit to do so. We have this day received from Mr. Gorman a letter notifying us that he elected not to purchase the deposited shares, and declaring that the agreement of April 3, 1899, is of no effect. The following is a copy of his notice:

"WASHINGTON, D. C., May 15, 1899.

"Messrs. John C. Bullitt and John R. McLean, Committee: Gentlemen—As less than 87,000 shares of the stock of the Washington Gas Light Company have been deposited up to the close of business today, we now notify you that we elect not to purchase the deposited shares and that our agreement with you of April 3, 1899, is of no effect. Kindly have forwarded to the United States Mortgage and Trust Company, 59 Cedar street, New York City, by check to its order the cash deposit made by me under that agreement. Yours very truly, A. P. GORMAN."

Under the notice given by him to the Committee the agreement for the sale becomes null and void. You are, therefore, entitled to the return of your stock by the Fourth National Bank when demanded by you. You will, therefore, please call upon the bank with the receipt or certificate given you for your stock by the bank, and upon the surrender by you of that certificate the bank will return you your stock. You will understand that you will have your stock returned to you free of any expense, as the costs incurred by the Committee were provided to be paid out of the fund deposited by Mr. Gorman with the Fourth Street National Bank. If you transmitted your stock through Mr. McLean at Washington, and will call upon him with the bank receipt held by you, he will transmit it to the Fourth Street Bank, and have the bank to send your stock to him by mail, and you can then receive your stock from him.

JOHN C. BULLITT,
JOS. C. ROSENGARTEN,
JNO. R. MCLEAN,
JAS. W. ORME,
JNO. J. RODGERS,
} Committee.

THE Augusta (Ga.) *Chronicle* says that, up to May 18th, Mr. E. C. Brown, of New York, had not completed his arrangements for the purchase of a controlling interest in the Gas Light Company, of Augusta, Ga.

THE incorporators of the Tennessee Gas and Coke Company, who propose to operate a gas works in Knoxville, Tenn., by virtue of an enabling ordinance passed the 5th inst., have perfected the following executive organization: Directors, F. S. Hambleton and John N. Steele, of Baltimore, Md., and C. H. Harvey, Leon Fender, Robert K. Howard, C. C. Howell and H. L. McClung, of Knoxville, Tenn.; President, Frank S. Hambleton; Vice President and General Manager, C. C. Howell; Secretary, C. H. Harvey; Treasurer, L. Fender.

"P. B. M.," writing to us under date of the 22d inst., says: "In Mr. Norton H. Humphrys' communication, on the subject of "Large Gasholders in England," in your issue dated to-day, it is stated that a 200-foot holder, containing 4¾ million feet, if increased in diameter 10 feet would contain 5¾ million feet. This is not so, as the contents of the holder would only be increased 487,000 feet by a 10-foot increase in diameter. A 20-foot increase in diameter would increase the capacity 1,000,000 feet. The error is probably a clerical one, and the statement

should have read, 'Increase the diameter only 20 feet,' etc." As our correspondent suggests, the error was a typograpical one, rather than a mistake on the part of Mr. Humphrys.

THE Navy Department some days ago issued the following notice: "Notice is hereby given that, from about May 20 to July 20, 1899, a bright light *may* appear from the standpipe of the New England Gas and Coke Company, at Everett, Boston Harbor, caused by the burning of a large quantity of surplus gas, at a height of about 180 feet above mean high water."

MR. A. T. SCHUESSLER, official inspector of gas and gas meters for Newark, N. J., since the creation of that position in 1875, died at his home in that city, the evening of the 16th inst. Deceased was born in Darmstadt, Germany, in 1839, and was trained to the profession of a chemist. In 1859 he came to America, and obtained a position with one of the New York city gas companies. As noted above he went to Newark in 1875. He was a veteran of the Civil War, having served in the 45th New York Volunteers. He is survived by a widow, a son and a daughter.

MR. J. H. FINDLAY has disposed of his holdings in the artificial lighting interests of Malone, N. Y. The consolidated gas and electric lighting supply will probably be carried out by a corporation to be known as the Malone Light and Power Company.

A CORRESPONDENT in Washington, D. C., writing under date of the 24th inst., wants to know our authority for the statement made in last issue, that the authorities of Memphis, Tenn., have decided to apply the $50,000 forfeit received from the Memphis and Equitable Gas Light Companies, in consideration of their having been allowed to consolidate their interests, to the building of a police central station house. Our reply is simply to reproduce the text of the ordinance, entitled, "Police Station Ordinance," which was passed to a third and final reading on the 8th inst.

"Section 1. Be it ordained by the Legislative Council of the city of Memphis, that the notes and indebtedness due the city by the New Memphis Gas Light Company and the Equitable Gas Light Company, under the ordinance of December 29, 1898, be discounted and sold, but at a rate of interest not exceeding 5 per cent. per annum, that the proceeds of said notes be paid into the lighting fund as required by the contract between the city and the Equitable Gas Light Company.

"Sec. 2. Be it further ordained that all the surplus of the lighting fund for the current year, that is to say, all the balance of the money, after deducting the amount necessary for lighting the city the current year, from the current appropriation to the lighting fund and the proceeds arising from the discount of said notes be and the same are hereby appropriated for the purpose of building and equipping a new police station at the corner of Second and Washington streets, on the city's lot.

"Sec. 3. Be it further ordained that architects be invited to submit plans and estimates for a new police station, the same not to cost over $50,000."

THE properties of the Hillsdale (Mich.) Gas Company have been purchased by Mr. Gordon W. Lloyd.

MR. CHARLES H. CHRISTIE, of Cleveland, Ohio, has been appointed Superintendent of the proposed opposition concern for Peoria, Ills., the corporate title of which is the Poples Gas and Electric Company.

AT the annual meeting of the Atlantic City (N. J.) Gas and Water Company a dividend of $1 per share was declared. The officers elected were: Directors, J. H. Borton, Thos. K. Reed, Charles Evans, Jno. E. Mehrer, Fred. Hemsley, J. B. Champion, John Roberts, Lavery Bradley, W. L. Elkins, P. A. B. Widener, Jas. McManus, George S. Cotton and J. Haines Lippincott; President, Jos. H. Borton; Treasurer, Thomas K. Reed; Secretary and General Manager, Jno. P. Tompkins.

AT a meeting of the Directors of the Washington (D. C.) Gas Light Company, held last Monday, the regular dividend of 50 cents per share was declared, and an extra one of $1 per share.

MR. J. J. MCKEEVER, the energetic and popular Secretary of the Houston (Texas) Gas Light Company, reports a very brisk demand for gas stoves this season. Much of this demand is chargeable to the series of demonstration lectures on cooking by gas given some time ago in Houston by Miss Andrews.

ARTICLES recording the incorporation of the Middlesex County Gas Company, to furnish gas for all purposes in New Brunswick, N. J., have been filed by Messrs. Chas. W. Smith, M. W. Weir and James A. Smith. The capital is returned at $125,000.

A CORRESPONDENT forwards the following: "The main points in the ordinance before the City Council of Nelson, British Columbia, respecting the proposed gas works for that place, are: That a franchise be granted to Messrs. W. H. Pearson, W. H. Pearson, Jr., L. L. Merrifield and J. T. Westcott That within 60 days from the passage of the by-law to be submitted to the ratepayers, the Company should commence the establishment of coke and gas works, and buildings adequate to the supply of gas within the limits of the city, and within six months should proceed with due diligence to lay the requisite length of mains, and supply therewith the gas required, and within two years after the passage of the by-law expend upon the construction of the said coke and gas works and the laying of mains a sum not less than $100,000, or forfeit its rights secured under the franchise. The provision inserted for the protection of the city's business in the supplying of light recited that in no case shall the Company charge more for the gas supplied for private lighting purposes than $3 per 1,000 cubic feet, without the consent of the City Council, and gas for lighting the streets within the city limits at a price not exceeding $2, and gas for supplying the corporation with power at a price not exceeding $1 per 1,000. It was also provided that the city shall have the right, at the expiry of 10 years from the passing of the by-law, to take over and own the Company's plant at a price to be determined by a board of arbitration, such value to be based on the value of the plant as a going concern, but no value shall be determined as inuring to the Company by reason of its possessing the franchise. The Company by the by-law is given an exclusive franchise for 25 years, and the location of its works is subject to the approval of the City Council.—A. F. Y."

THERE is a hitch in the matter of the proposed acquirement of the New Brunswick (N. J.) works by the syndicate who bid $81 per share for the stock—the par of the latter is $20.

A MEETING of the shareholders in the Warren County Gas Company, of Phillipsburg, N. J., to consider proposed alterations in its by-laws, has been called. The session will be held at 3 P.M. of the 3d prox.

No franchise will be granted for an opposition gas company by the authorities of Rutland, Vt.

MR. HIGHLANDS is at it again, as may be well judged from the notice recently issued to the residents of Clinton, Iowa, by the Clinton Gas Light and Coke Company, which bears the promise that, on and after October 1st, 1899, the rate charged for gas for cooking, heating and power use, will be $1 per 1,000 cubic feet.

THE Capital Tramway Company of Buenos Aires, Argentina, has placed an order with the Berlin Iron Bridge Company, of East Berlin, Conn., for a steel water tower to support a tank having a capacity of 7,000 gallons. This is the fifth order the Berlin concern has received from the parties of the first part.

THE $1.50 rate for gas used for fuel purposes, recently instituted by the proprietors of the Webster (Mass.) Electric Company, has been the means of largely increasing its output.

AT the annual meeting of the Portland (Me.) Gas Light Company the officers elected were: Directors, Edward H. Daveis, Elias Thomas, Wm. H. Moulton, Fred. N. Dow, Chas. S. Fobes and Rufus Lamson; President, Edward H. Daveis; Treasurer and Clerk, Fred. E. Moore.

THE Berlin Iron Bridge Company, of East Berlin, Conn., is putting up a new machine room for the Duncan Company, at Mechanicsville, N. Y. The building is 72 feet wide by 170 feet long, and the roof trusses are arranged with trolley beams and hoists, so that the rolls of paper can be lifted in and out of the machines by means of power.

A. R. DIETZ is informed that the Agent for the Danvers (Mass.) Gas Light Company is Mr. J. F. Porter.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.
PACIFIC COAST GAS ASSOCIATION.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

Notification Respecting Advertising.—Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, MAY 29, 1899.

A Novel Marine Illuminating Device.

Iron Age says that a demonstration of the capabilities of the Willson illuminating shell, a novel marine device, which took place recently in Baltimore, Md., is thus described in the *Herald* of that city :

The shell is an apparatus for lighting up the sea at night. It is in the shape of an ordinary projectile, and may be thrown from a gun in the direction of an enemy or dropped overboard alongside a ship, as the occasion may require. It is buoyant, and, striking the water, becomes an illuminating plant of itself, shedding a powerful light over the water.

It is the invention of Col. William J. Willson, the acetylene gas expert, and consists of a hollow cylinder, made from drawn steel tubing, in sizes from 3 to 6 inches or more in diameter and from 3 to 5 feet in length, according to the purpose for which it is to be used. The shell is loaded with calcium carbide, from which acetylene gas is generated instantly upon contact with water. At one end of the shell are the burners, from which the gas escapes as generated and is lighted by electricity generated by a battery within the shell. It takes less than 30 seconds to make the shell ready for firing from a gun or throwing overboard. On falling into the water it floats a quarter of its length above the surface, and the water, entering small holes near the base, comes in contact with the calcium carbide, which is instantly converted into acetylene gas, which in turn is at once ignited at the burners by the self-generating electric current.

A large tank of water was used in connection with the experiment. No sooner was the big shell plunged into the water than it sank, then rose like a can buoy, righted itself, and from the burners at the top there shot a white flame that dazzled the eyes of the beholders. The clustered burners emitted a blaze, which at sea, on a dark night, would have been a powerful beacon. The shell was forced under the surface as though submerged by a powerful wave, and on the water there appeared a flame such as is created by oil burning on the surface. The burners were then from 3 to 4 inches under. Again the shell was sent below, and this time the light was entirely extinguished. Being released it came to the surface like a cork, and instantly the little electric plant in the shell fired the gas and the burners were ablaze. This experiment was tried again and again. The device cannot be permanently extinguished by water washing over it, and cannot be put out by natural or mechanical current of air. It is stated that the shell would be invaluable as an adjunct to the life saving service, as well as in naval warfare, and, in fact, for any service that requires illumination of the sea. The shell is being manufactured by the American Illuminating Shell Company, a Baltimore corporation.

Ford's Pump Governor.

Thos. P. Reed, of Brooklyn, N. Y., has devised a pump governor which comprises a casing in which a diaphragm is held. A tube extends through the diaphragm and communicates with the liquid to be pumped and with the valve controlling the steam supply pipe of the pump, which valve carries a weighted lever. When the liquid to be pumped rises, it passes into the tube and ascends until the weight of the column of liquid is sufficient for the weighted lever to overbalance the weight of the stationary column on top of the diaphragm, so that the tube moves up and the valve is opened to permit steam to pass to the pump. When the level of the liquid falls, the reverse operation takes place.

The Market for Gas Securities.

The gentlemen who, in their positions as Directors of the Consolidated Gas Company of this city, are supposed to conserve the interests of the shareholders, to-day (Friday) treated the aforesaid shareholders in a way that must convince the latter that they are being well protected. The Directors declared a dividend for the last quarter amounting to 1½ per cent., which puts the shares on a 6 per cent. instead of an 8 per cent. basis. The further announcement was made that the books will close June 1st to be reopened June 15th. The immediate effect was a break in the shares to 170, and, judging from the nature of the sales reported, quite some investment stock was being put out and taken in. No further step can be taken to influence the market just now, unless the Directors meet before the 15th prox. and pass a resolution to annul the dividend declared to-day. Meanwhile the merry war goes on. Our earnest advice to shareholders who hold their stock for investment is not to let go, for as sure as the Company exists its shares are worth $250 each. Amsterdam common is 33 to 34 ; Standard common is 120 to 125.

Brooklyn Union, in sympathy with its New York relations, is down to 139, at which figure it looks very tempting. Peoples, of Chicago, is 119 to 119½, and Consumers, of Jersey City, is 95 bid. Our quotation for Washington gas came in this morning at 203 bid, which is likely an error. The Company has declared cash dividends amounting to $1.50 per share. Bay State is 2⅛ to 2¾. Cincinnati gas sold down to 182, but recovered to 186 ; the contention there by certain speculators for the right to supply natural gas, which, of course, is but the entering wedge for an opposition concern, is responsible for the drop.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

May 29.

☞ All communications will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$39,078,000	100	170¼	170¾
Central Union, Bonds, 5's.	3,000,000	1,000	107½	108½
Equitable Bonds, 6's	1,000,000	1,000	105	.
" 1st Con. 5's	2,300,000	1,000	115	118
Metropolitan Bonds	658,000	.	108	112
Mutual	3,500,000	100	300	320
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	
New Amsterdam Gas Co.	13,000,000	100	34½	35½
Preferred	10,000,000	100	60¼	63
Bonds, 5's	11,000,000	1,000	100½	101
Northern Union, Bonds, 5's.	1,250,000	1,000	95	97
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	109	111
" 1st Con. 5's	1,500,000	..	112	114
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	120	125
Preferred	5,000,000	100	140	145
Bonds, 1st Mortgage, 5's	1,500,000	1,000	112	114
Yonkers	299,65	500	180	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	139	139¼
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	2⅝	2¾
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works.	450,000	100	40	..
" 1st Mtg. 5's	450,000	1,000	95	98
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	92	..
2d " " "	3,000,000	1,000	68	71
Buffalo City Gas Co.	5,500,000	100	12	14
" " Bonds, 5's	5,250,000	1,000	89	91
Central, San Francisco	2,000,000	..	105	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus	1,144,700	100	70	75
1st Mortgage	1,207,000	1,000	106	108
Consumers, Jersey City	2,000,000	100	95	.
" Bonds	600,000	1,000	107½	110
Cincinnati G. & C. Co.	8,500,000	100	186	187
Consumers, Toronto	1,700,000	50	230	235
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	11,000,000	100	65¼	66
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's.	1,000,000	..	..	..
Equitable, 1st 6's.	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	23	25
" Con. Mtg. 5's	380,000	1,000	80	82
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,360,000	50	65	65½
" Prior Lien 5's	4,846,000	1,000	94¾	94½
Detroit Gas Co., 5's	423,000	1,000	95½	96
" Inc. 5's	31,000	100	..	..
quitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	62	65
" Bonds	2,000,000	..	80	85
Grand Rapids Gas Lt. Co.	1,000,000	50	..	..
" 1st Mtg. 5's	1,125,000	1,000	..	..
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	122	128
" Bonds, 6's	2 650,000	..	105	106
Jackson Gas Co	250,000	50	..	..
" 1st Mtg. 5's	250,000	1,000	..	..
Jersey City	750,000	20	225	275
Lafayette Gas Co., Ind.	1,000,000	100	68	70
Bonds	1,000,000	1,000	81	86

Louisville	2,570,000	50	106	108
Laclede, St. Louis	7,500,000	100	53	54
Preferred	2,500,000	100	100	103
Bonds	10,000,000	1,000	107	108
Madison Gas & Elec. Co.	400,000	100	68	70
" 1st Mtg. 6's	350,000	1,000	102	..
Montreal, Canada	2,000,000	100	200	..
Newark, N. J., Gas Co.	1,000,000	..	200	220
Bonds, 6's	4,000,000	..	128	130x
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	53½	55
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	119⅛	119¼
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	,000	111½	112
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	215	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	74	75
St. Paul Gas Light Co.	1,500,000	100	50	52
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's	2,428,000	1,000	80	82
St. Joseph Gas Co.	1,000,000	100	..	..
" 1st Mtg. 5's	750,000	1,000	..	..
Syracuse, N. Y.	1,750,000	100	16	19
Bonds	1,612 000	1,000	85	89
Washington, D. C	2,000,000	20	203	..
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	100	97	97¾
Bonds, 5's	3,880,500	.	106	108
Wilmington, Del	550.000		208	..

Advertisers' Index.

GAS ENGINEERS.

Page

Wm. Henry White, New York City ... 835
Fred. Bredel, Milwaukee, Wis. ... 822
Geo. R. Rowland, New York City ... 819
The Western Gas Construction Co., Fort Wayne, Ind. ... 800
Humphreys & Glasgow, New York City ... 820
American Gas Co., Phila., Pa. ... 822
David Leavitt Hough, New York City ... 832
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 819
Baxter & Young, Detroit, Mich. ... 832
United Gas Improvement Co., Phila., Pa ... 827
James T. Lynn, Detroit, Mich. ... 832
A. E. Boardman, Brevard, N. C. ... 832

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md. ... 833
United Gas Improvement Co., Phila., Pa. ... 827
Burdett Loomis, Hartford, Conn. ... 834
National Gas and Water Co., Chicago, Ills. ... 829
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 819
The Western Gas Construction Co., Fort Wayne, Ind. ... 800
Humphreys & Glasgow, New York City ... 820

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd's Sons, New York City ... 836
Continental Iron Works, Brooklyn, N. Y. ... 834
Deily & Fowler, Phila., Pa. ... 836
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 832
Stacey Mfg. Co., Cincinnati, Ohio ... 835
Bartlett, Hayward & Co., Baltimore, Md. ... 833
Davis and Farnum Mfg. Co., Waltham, Mass. ... 832
R. D. Wood & Co., Phila., Pa. ... 834
Isbell-Porter Company, New York City ... 834
Fred. Bredel, Milwaukee, Wis. ... 822
United Gas Improvement Co., Phila., Pa. ... 827
National Gas and Water Co., Chicago, Ills. ... 829
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 819
The Western Gas Construction Co., Fort Wayne, Ind. ... 800
Humphreys & Glasgow, New York City ... 820
American Gas Co., Phila., Pa. ... 822
Logan Iron Works, Brooklyn, N. Y. ... 836
Riter-Conley Mfg. Co., Pittsburgh, Pa. ... 835
Baxter & Young, Detroit, Mich. ... 832
Berlin Iron Bridge Co., East Berlin, Conn. ... 821
G. Shepard Page's Sons, New York City ... 932
James T. Lynn, Detroit, Mich. ... 832
A. E. Boardman, Brevard, N. C. ... 832

SCRUBBERS AND CONDENSERS.

R. D. Wood & Co., Phila., Pa. ... 834
James R. Floyd's Sons, New York City ... 836
Continental Iron Works, Brooklyn, N. Y. ... 834
Logan Iron Works, Brooklyn, N. Y. ... 836
Riter-Conley Mfg. Co., Pittsburgh, Pa. ... 835

TAR AND CARBONIC ACID EXTRACTOR.

R. D. Wood & Co., Phila., Pa. ... 834

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich. ... 818

GAS METERS.

John J. Griffin & Co., Phila., Pa. ... 840
American Meter Co., New York and Philadelphia ... 839
Helme & McIlhenny, Phila., Pa. ... 839
D. McDonald & Co., Albany, N.Y. ... 837
Nathaniel Tufts Meter Co., Boston, Mass. ... 838
Maryland Meter and Mfg. Co., Baltimore, Md. ... 838
Metric Metal Co., Erie, Pa ... 839
Keystone Meter Co., Royersford, Pa. ... 838
Detroit Meter Company, Detroit, Mich. ... 839

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia ... 839
John J. Griffin & Co., Phila., Pa. ... 840
D. McDonald & Co., Albany, N. Y. ... 837
Helme & McIlhenny, Phila., Pa. ... 839
Nathaniel Tufts Meter Co., Boston, Mass. ... 838

GAS AND WATER PIPES.

M. J. Drummond & Co., New York City ... 837
R. D. Wood & Co., Phila., Pa. ... 834
Warren Foundry and Machine Co., New York City ... 837
Donaldson Iron Co., Emaus, Pa. ... 837
Utica Pipe Foundry Co., Utica, N. Y. ... 837

PIPE CUTTERS.

The Anderson Pipe Cutter Co., East Boston, Mass. ... 819

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., N. Y. City ... 818

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, Brooklyn, N. Y. ... 829

GAS COALS.

Penn Gas Coal Co., Phila., Pa. ... 831
Perkins & Co., New York City ... 830
Despard Gas Coal Co., Baltimore, Md. ... 831
Westmoreland Coal Co., Phila., Pa. ... 831
Berwind-White Coal Mining Co., New York and Phila. ... 830

CANNEL COALS.

Perkins & Co., New York City ... 830

GAS ENRICHERS.

Standard Oil Co., New York City ... 831
The Sun Oil Co., Pittsburgh, Pa. ... 831

COKE CRUSHER.

C. M. Keller, Columbus, Ind. ... 831

GAS GAUGES.

The Bristol Co., Waterbury, Conn. ... 820

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City 829
Isbell-Porter Co., New York City ... 834
R. D. Wood & Co., Phila., Pa. ... 834
Wm M. Crane Co., New York City ... 820

CEMENTS.

C. L. Gerould & Co., Mount Vernon, N.Y. ... 828

RETORTS AND FIREBRICKS.

J. H. Gautier & Co., Jersey City, N. J. ... 828
B. Kreischer & Sons, New York City ... 828
Adam Weber, New York City ... 828
Laclede Firebrick Mfg. Co., St. Louis, Mo. ... 828
Cyrus Borgner, Phila., Pa. ... 823
James Gardner, Jr., Pittsburgh, Pa. ... 828
Henry Maurer & Son, New York City ... 828
Baltimore Retort and Firebrick Co., Baltimore, Md. ... 828
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. ... 828
Brooklyn Firebrick Works, Brooklyn, N. Y. ... 823

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md. ... 833
Fred. Bredel, Milwaukee, Wis. ... 822
J. H. Gautier & Co., Jersey City, N. J. ... 828
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. ... 828
Adam Weber New York City ... 828

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Co., New York City ... 834
Continental Iron Works, Brooklyn, N.Y. ... 834
Logan Iron Works, Brooklyn, N. Y. ... 836
R. D. Wood & Co., Phila., Pa. ... 834

INCANDESCENT GAS LAMPS.

Welsbach Commercial Co., Phila., Pa. ... 826

BURNERS.

C. A. Gefrorer, Phila., Pa. ... 834
Wm. M. Crane Co., New York City. ... 818
D. M. Steward Mfg. Co., Chattanooga, Tenn. ... 818

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn. ... 818

STREET LAMPS.

Welsbach Street Lighting Co., New York and Phila. ... 824
Thos. T. W. Miner, New York City ... 819

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 829
Greenpoint Chemical Works, Brooklyn, N.Y. ... 829
van Baarda & Co., Dusseldorf-on-the-Rhine ... 829

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y. ... 820
Chapman Valve Manufacturing Co., Boston, Mass. ... 820
R. D. Wood & Co., Phila., Pa. ... 834
Continental Iron Works, Brooklyn, N. Y. ... 834
The P. H. & F. M. Roots Co., Connersville, Ind. ... 823
Isbell-Porter Co., New York City ... 834
The Western Gas Construction Co., Fort Wayne Ind. ... 800

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind. ... 823
Isbell-Porter Company, New York City ... 834
Connelly Iron Sponge and Governor Co New York City 829

ELECTRICAL APPARATUS.

Wm. Henry White, New York City ... 835

GAS ENGINES.

Backus Water Motor Co., Newark, N. J. ... 818

ENGINES AND BOILERS.

The Hazelton Boiler Company, New York City ... 819

PURIFIER SCREENS.

John Cabot, New York City ... 830

GAS STOVES.

American Meter Co., New York and Philadelphia ... 835
Maryland Meter and Manufacturing Co., Baltimore, Md. 838
Keystone Meter Co., Royersford, Pa. ... 838
Wm. M. Crane Co., New York City ... 820
Detroit Stove Works, Detroit, Mich. ... 658
George M. Clark & Co., Chicago, Ills. ... 618

HOT WATER HEATERS.

J. P. B. Sadtler & Co., Baltimore, Md. ... 818
Wm. M. Crane Co., New York City ... 820

GASHOLDER TANKS.

J P. Whittier, Brooklyn, N. Y. ... 820

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md. ... 833
Continental Iron Works, Brooklyn, N. Y. ... 834
Deily & Fowler, Philadelphia, Pa. ... 836
Davis & Farnum Mfg. Co., Waltham, Mass. ... 832
Kerr Murray Mfg. Co., Fort Wayne, Ind. ... 832
Stacey Mfg. Co., Cincinnati, Ohio ... 835
R. D. Wood & Co., Philadelphia, Pa. ... 834
Logan Iron Works, Brooklyn, N. Y. ... 836
Riter-Conley Mfg. Co., Pittsburgh, Pa. ... 835

CHEMICALS.

Emken Chemical Co., New York City ... 818

PATENTS.

H. S. Thornberry, Washington, D. C. ... 837

BOOKS, ETC.

Newbigging's Handbook ... 824
Scientific Books ... 830
Digest of Gas Cases ... 831
Practical Photometry ... 828
Gas Flow Computers ... 831
Hughes' "Gas Works" ... 829
Gas Engineer's Pocket-Book ... 821
Excerpts from Reports of Gas Commissioners ... 833
Poole on Fuels ... 819
Binders ... 837

DIVIDEND NOTICE.

OFFICE OF THE AMERICAN GAS COMPANY,
222 S. THIRD ST., Phila., Pa., May 17, 1899.

The Board of Directors of The American Gas Company have this day declared a quarterly dividend of 1½ per cent., or $1.50 per share, on the outstanding Capital Stock of the Company, payable on and after June 1, 1899.

1251-1 MORRIS W. STROUD, Treas.

Situation Wanted

by a young man 25 years old, who has had seven years' experience in the gas business, both coal and water, inside and outside. Not afraid to work. Can furnish best of references. Address

1251-1 "J. M. J.," care this Journal

Position Desired.

A Competent and Up-to-Date Gas Engineer and Manager

wants position July 1st or August 1st. Address "W. A. L.,"

1251-4 care this Journal.

Position Wanted

As Superintendent or Manager of a Gas Property

in a city of from 5,000 to 20,000 population. Has had 12 years' experience in both coal and water gas works. Has been successful in increasing business. Would invest some money in a good place. References exchanged.

1245-3 Address "M.," care this Journal.

Position Wanted.

On account of changes made in my present Company, I will sever my connection therewith on February 20, and solicit correspondence with Gas Companies contemplating a change of management. Eight years with present Company. References. E. G. HOLZER, Supt. Gas Dept.,

1228-tf Roanoke Gas and Water Co., Roanoke, Va.

SECOND-HAND APPARATUS.

I am in position to offer at attractive prices, a considerable quantity of good, usable second-hand Gas Apparatus, of various kinds and sizes, such as Purifiers, Station Meters, Exhausters, Scrubbers and Condensers, Bench Ironwork, Water Gas Machinery, Tanks, etc., etc. Gas Companies or Contractors who can use such will find it worth while to write for prices, stating their requirements. Gas Companies having apparatus to dispose of are invited to communicate upon the matter. F. H. SHELTON,

315 Fidelity Building, 112 N. Broad St., Phila.

For Sale.

A Small Gas and Electric Light Plant,

in a Southern city of 3,800 inhabitants.

Address FORT WAYNE ELECTRIC CORPORATION,

1097-tf Fort Wayne, Ind.

We give you

144

perfect Lava Tips with every Gross you buy.

"A CEASAR COULD DO NO MORE."

Gas Companies should insist upon getting the Best.

MADE BY

The D. M. Steward Mfg. Co.,

N. Y. Office, 107 Chambers St. CHATTANOOGA TENN.

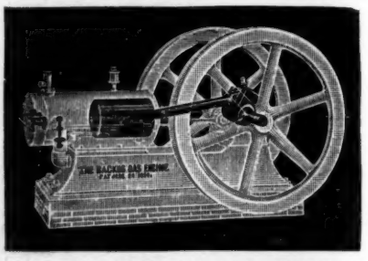
Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator.

Not Expensive. Write to STROH & OSIUS, Pat'ees. or Mich. Ammonia Works. Detroit. Mich.

BACKUS GAS ENGINES.



GUARANTEED SUPERIOR IN EVERY WAY. BUILT ON HONOR.

Agts. { Chicago Water Motor & Fan Co., 101 Lake St., Chicago. Michell & Co., - - 154 Congress Street, Boston, Mass.

Home Office, **Backus Water Motor Co.**, Newark, N. J.

Send for Catalogue.

Emken Chemical Co.,

175 South Street, New York City. Works, Long Island City, N. Y.

MINERS OF MONAZITE AND MANUFACTURERS OF

THORIUM AND CERIUM NITRATE.

ALSO MANUFACTURERS OF

INCANDESCENCE FLUID

For Making Non-Shrinking Mantles of Highest Luminosity.

SAFETY GAS MAIN STOPPER Co.

211-E. 116 TH ST. N.Y.

FOR SHUTTING OFF GAS IN MAINS TEMPORARILY DURING ALTERATIONS AND REPAIRS

BRAY'S BURNERS

Are Used in every Country in the World.

Owing to the steadily increasing demand year by year, additions to factory and plant have been constantly made, resulting in the largest and best equipped Burner plant in the world. Burners are made for all pressures and conditions. There is but one "BRAY" Burner. Accept no imitation. Write for our new Pamphlet.

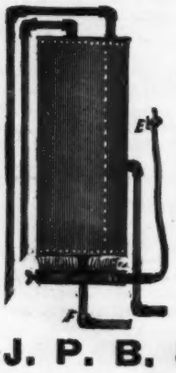
If interested in ACETYLENE BURNERS send for samples.

WILLIAM M. CRANE COMPANY,

Nos. 1131 and 1133 Broadway, New York City.

With Bray Burner.

An Economical Hot Water Heater.



PERFECT COMBUSTION. NO SMOKE. NO ODOR.

FULLY GUARANTEED.

Will heat the Water in a Boiler in less than half the time required by a Range, and at less than half the expense. Nothing to get out of order, and will last a lifetime.

BUFFALO CITY GAS CO., BUFFALO, N.Y., April 1, 1899.
J. P. B. SADTLER & Co., 813 S. Howard St., Baltimore, Md.
Gentlemen—Replying to your favor of the 30th of March. The Heller Heaters that you have already furnished seem to be large enough, and we will not at present care to use any of the larger size that you mention. We have had no complaint in regard to the Heller Heater that we have used in Buffalo, and so far they are giving us good satisfaction.
Yours very truly, E. H. JENKINS, Engineer.

BALTIMORE, MD., March 24, 1899.
J. P. B. SADTLER & Co., 813 S. Howard St., Baltimore, Md.
Gentlemen—A test of the Heller Water Heater witnessed by me March 21, 1899, showed that with a consumption of 30 feet of gas per hour, the water in a 28 gallon galvanized boiler could be heated from 59° to 102°, or 43° in one hour. Temperature of room at time of test 64°.
Respecfully,
GEO. BEADENKOPP, Ass't Engineer, Con. Gas Co.

Clamp Heater to Pipe about 4 Inches away from bottom of Boiler. Always use an independent connection, or regular Gas Stove connection, so as to get a good flow of Gas.

J. P. B. SADTLER & CO., 813 South Howard Street, Baltimore, Md.

W. H. PEARSON, Prest. W. H. PEARSON, Jr., Vice-Prest. J. T. WESTCOTT, M.E., Manager. L. L. MERRIFIELD, M.Inst.M.E., Chief Engineer.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION CO., LD.

American Offices: 269 FRONT STREET, EAST, TORONTO, ONT.
London Offices: 19 ABINGDON STREET, WESTMINSTER, S.W.

Telegraphic Address: "CARBURETED LONDON AND TORONTO."

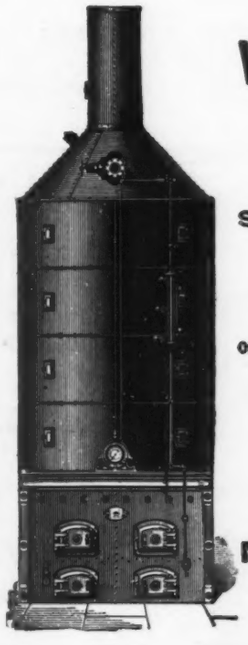
The above Company have erected since 1893, or are now erecting, their universal type of Carbureted Water Gas Plants at the following Gas Works:

	Cubic Feet Daily.
Blackburn, Eng.	1,250,000
Windsor Street Works, Birmingham, Eng.	2,000,000
Saltley Works, Birmingham, Eng.	2,000,000
Colchester, Eng.	300,000
Birkenhead, Eng.	2,250,000
Swindon (New Swindon Gas Co.), Eng.	120,000
Saltley Works, Birmingham, Eng. (2d Contract)	2,000,000
Windsor St. W'ks, Birming'm, Eng. (2d Contract)	2,000,000
Halifax, Eng.	1,000,000
Toronto,	250,000
Ottawa,	250,000
Toronto (Second Contract, Remodeled),	2,000,000
Lindsay (Remodeled),	125,000
Belleville,	250,000
Ottawa (Second Contract),	250,000
Brantford (Remodeled)	200,000
St. Catherine's (Remodeled),	250,000
Kingston, Pa.	125,000
Montreal,	500,000
Peterborough, Ont.	250,000
Wilkesbarre, Pa.	750,000
St. Catherine's (Second Contract),	250,000
Buffalo, N. Y.	2,000,000
Winnipeg, Man.	500,000
Colchester, Eng. (Second Contract),	300,000
York, Eng.	750,000
Rochester, Eng.	500,000
Kingston, Ont.	300,000
Crystal Palace District, Eng.	2,000,000
Duluth, Minn.	300,000
Caterham, Eng.	150,000
Leicester, Eng.	2,000,000

"THE MINER"
Globe
Street and Boulevard
Lamps.
Cheapest and Best.
THOUSANDS IN USE WITH INCANDESCENT BURNERS.
Send for Catalogues.
THOMAS T. W. MINER,
821-823 Eagle Av., N. Y.

GEORGE R. ROWLAND.
Formerly with the Continental Iron Works.
Draughtsman and Constructing Engineer.
Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.
Office, No. 245 Broadway, N. Y. City.

The Gas Engineer's
Laboratory Handbook.
By JOHN HORNBY, F.I.C.
Price, $2.50.
A. M. CALLENDER & CO., 32 Pine Street, N.Y. City.



HIGH-PRESSURE
WATER-TUBE BOILERS.
THE HAZELTON OR PORCUPINE BOILER
IN 50 to 500 H. P. UNITS.
SINGLE BOILERS OR COMPACT BATTERIES.
GREAT SAVING OF FLOOR SPACE AND FUEL.
LARGE-SIZE BOILERS IN STOCK.
Our new book, "The Generation of Power," will be mailed on request.
THE HAZELTON BOILER CO.
Sole Proprietors and Manufacturers.
ALSO BUILDERS OF
Stacks, Tanks and Miscellaneous Metal Work.
GENERAL OFFICE:
No. 716 E. 13th ST., New York, U.S.A.
Cable Address, "Paila," New York.
Telephone Call, 1229-18th Street, New York.

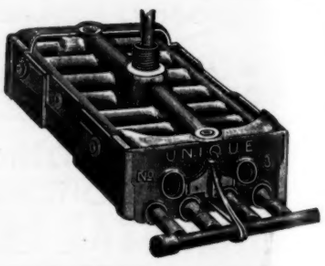
THE ANDERSON Patent Cutter Carrying Link
Made in all sizes.

Will cut from 2 in. to 24 in.
Pipe Cutting Tool
For Cutting Cast, Wrought Iron, Gas & Water Pipes.
THE ANDERSON PIPE CUTTER COMPANY, Manufacturers,
163 Liverpool st., E. Boston, Mass
N. Y. Office, 135 Greenwich St
C. H. TUCKER, JR., Manager.
WALDO BROS.,
102 Milk Street, Boston, Mass

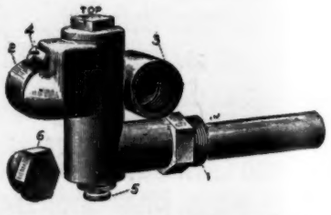
The Unique Gas Water Heater.

THE QUICKEST WATER HEATER MADE
USING THE SAME AMOUNT OF GAS.

SIMPLE, INEXPENSIVE, EASILY ATTACHED. CAN BE CONNECTED TO A COAL RANGE. NO VALUABLE SPACE IS WASTED, AS IT IS PLACED DIRECTLY UNDER THE BOILER, BETWEEN THE ARMS OF THE STAND.



The **VULCAN THERMOSTAT** can be applied to most any Water Heater, and automatically controls the gas supply. With its use there is absolutely no waste of gas.



The Vulcan Thermostat.

While the use of the Vulcan Thermostat is not essential in connection with the Unique Water Heater, when it is so attached the cost of fuel is reduced to a minimum, and perfect satisfaction is secured.

Gas Appliances of All Kinds.
Gas Tubing and Gas Fittings.

WILLIAM M. CRANE COMPANY,

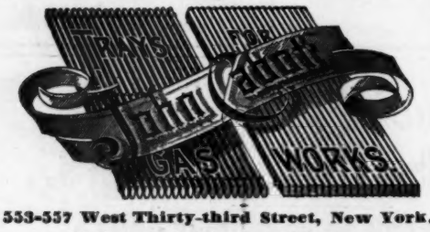
1131–1133 Broadway, New York.

Foundry at Peekskill, N. Y. **Catalogue No. 15 is the Latest.**

Special Trays for Iron Sponge or Oxide of Iron,

CHURCH'S TRAYS a Specialty.

Reversible, Strongest, Most Durable, Most Easily Repaired.



533-537 West Thirty-third Street, New York.

We also make the Cheapest and Strongest
REVERSIBLE BOLTED TRAYS IN THE MARKET.
Send for Circulars.

ALEX. C. HUMPHREYS, M. E., M. Inst. C. E. ARTHUR G. GLASGOW, M. E., M. Inst. C. E.

HUMPHREYS & GLASGOW,

BANK OF COMMERCE BLDG.,
31 Nassau Street,
New York.

9 VICTORIA STREET,
London, S. W.,
England.

CONSULTING GAS ENGINEERS
AND MANAGERS.
GAS PROPERTIES PURCHASED.

Bristol's Recording

PRESSURE GAUGE.

For continuous records of **Street Gas Pressure.** Simple in construction, accurate in operation, and low in price.

Fully Guaranteed. Send for Circulars.

THE BRISTOL CO.,
Waterbury, Conn.

CHAPMAN VALVE MANUFACTURING CO.

MANUFACTURERS OF

Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants with and without Independent Nozzle Valve. All Work Guaranteed.

Works & Gen'l Office, Indian Orchard, Mass. Treasurer's Office, 72 Kilby & 112 Milk Sts., Boston, Mass.
Chicago Office, 24 West Lake St. New York Office, 28 Platt St.
St. Louis Office, L. M. Rumsey Mfg. Co., 810 North Second St.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,

70 Rush St., Near Division Ave., **Brooklyn, N. Y.**

THE

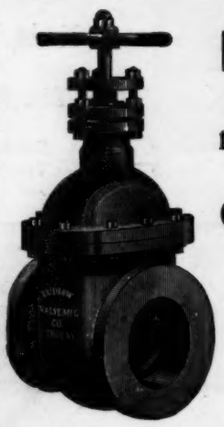
Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

Double and Single Gate Valves, ¼" to 72",

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.



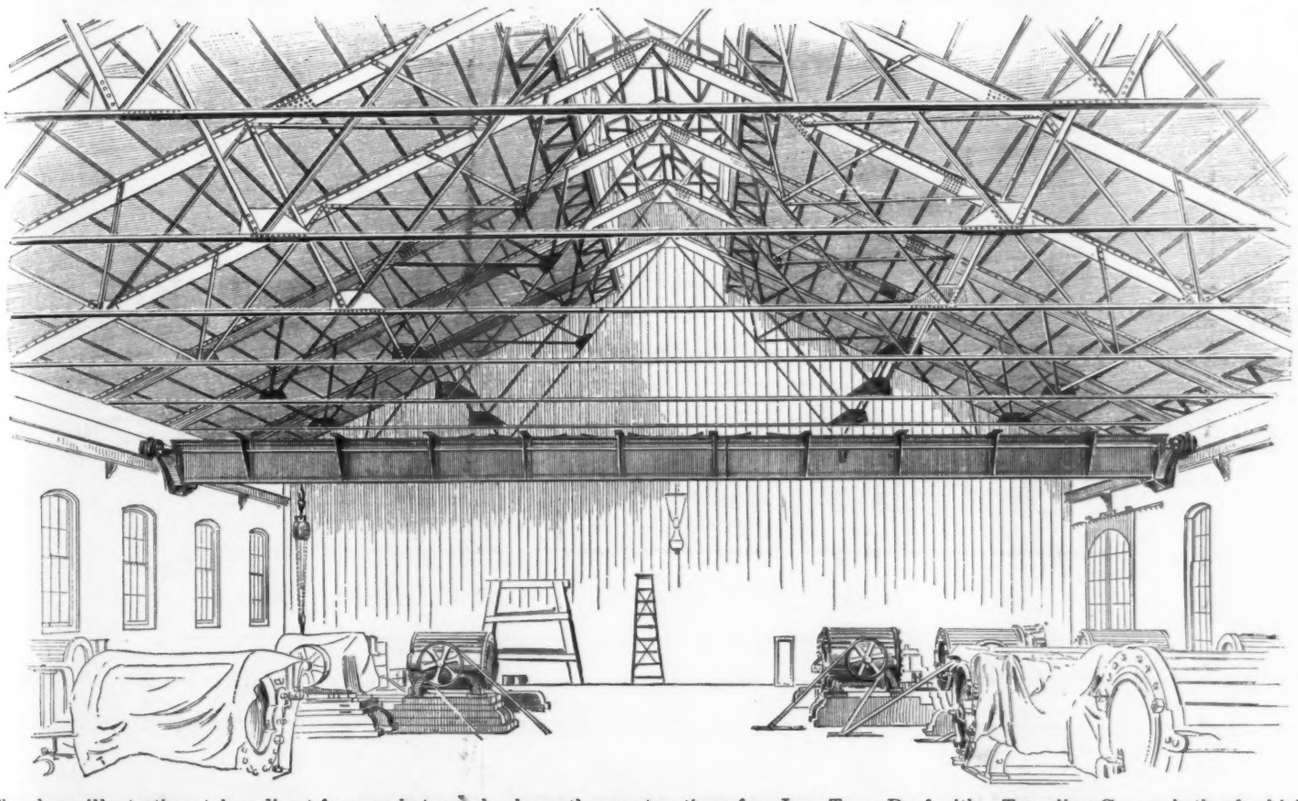
HOT GAS VALVES A SPECIALTY.

Send for Catalogue.

CHARLES M. JARVIS, President. GEORGE H. SAGE, Secretary. F. L. WILCOX, Treasurer.

THE BERLIN IRON BRIDGE CO.

Engineers, Architects and Builders of Steel Structures.



The above illustration, taken direct from a photograph, shows the construction of an Iron Truss Roof with a Traveling Crane, both of which were designed and built by us for the Narragansett Electric Lighting Company, at Providence, R. I. The illustration is taken in the Dynamo Room, which is 60 feet in width by 200 feet in length. The side walls are of brick, with Iron Roof Trusses covered with our Patent Anti-Condensation Corrugated Iron. This is the first roof ever built with this Patent Anti-Condensation Corrugated Iron, and after passing through three severe winters has shown no signs whatever of any dripping or sweating on the corrugated iron. We guarantee this Anti-Condensation Corrugated Iron Covering not to drip in the coldest weather.

BOSTON OFFICE, 200 Equitable Building.
NEW YORK OFFICE, 718 Bennet Building, Cor. Fulton and Nassau Streets.

Main Office and Works, EAST BERLIN, CONN.

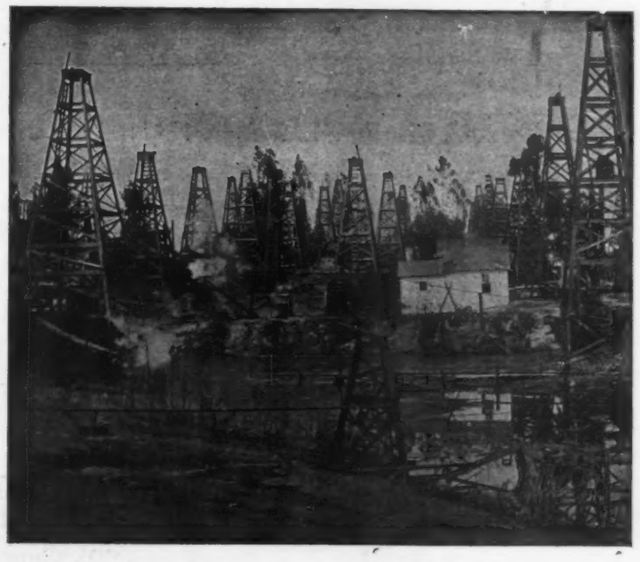
Gas Investments in California.

Nowhere else on this continent does such opportunity exist for profitable gas investment as on the Pacific Coast, since the perfection of the new LOWE Process for using the heavy crude California oils (of which there is an unlimited supply) without the use of any other fuels. Seven years' test proves the system to be perfect in every respect. Los Angeles alone, in addition to present street mains, has 150 miles of well built up streets without a gas main on them. To occupy this territory, and a large number of other towns now without gas, we have organized a parent company and a number of local companies covering some of the fastest growing cities in the United States.

Now is the time to invest, when the first capital will be able to double itself in a single year. This is also the most delightful residence section in the United States.

We suggest to those desiring gas investments, in large or moderate amounts—with or without active business connections—to come here and investigate; or, what is the next best thing, write us for particulars and prospectus.

The accompanying cut shows the oil wells in the suburbs of Los Angeles from which the Companies under the NEW LOWE GAS PROCESS obtain their supply of oil.



AMERICAN GAS & COKE CO. (T. S. C. Lowe, Manager),
406 Bradbury Building, Los Angeles, California.

AMERICAN GAS COMPANY

Constructors of Coal Gas Apparatus.

KLONNE-BREDEL

Recuperative Furnaces, Washers, Condensers, Purifiers and Purifying Machines, Ammonia Plant, Coke Conveyers, Etc.

Complete Works Erected with Guaranteed Results.

EASTERN AGENTS FOR

FRED. BREDEL'S SYSTEM
COAL GAS PLANTS AND GAS APPARATUS.

P. H. & F. M. ROOTS CO.'S
Exhausters, Blowers, etc.

222 South Third Street, Philadelphia, Pa.

GEORGE G. RAMSDELL, General Manager. **Correspondence Solicited**

FRED. BREDEL, C.E.

Coal and Water Gas Plants.

OWN SYSTEM.

RECUPERATIVE FURNACES, WASHERS, CONDENSERS, PURIFIERS, PURIFYING MACHINES, COKE CONVEYERS, ETC

SOLE UNITED STATES AGENT FOR
ARROL-FOULIS MECHANICAL CHARGING AND DRAWING MACHINES.

Gas Enriching Plants to Enrich Coal Gas up to 24 Candle Power, and Making a White, Bright, Non-smoking Gas

GAS RETORTS AND SPECIAL BLOCKS AND FIREBRICK MANUFACTURED UNDER THE SUPERINTENDENCE OF MY OWN CHEMIST.

COMPLETE GAS WORKS

No. 118 Farwell Avenue, · Milwaukee, Wis.

Eastern Agents: AMERICAN GAS CO., Construction Department, 222 So. 3d St., Phila., Pa

ROOTS'

LATEST IMPROVED GAS EXHAUSTER

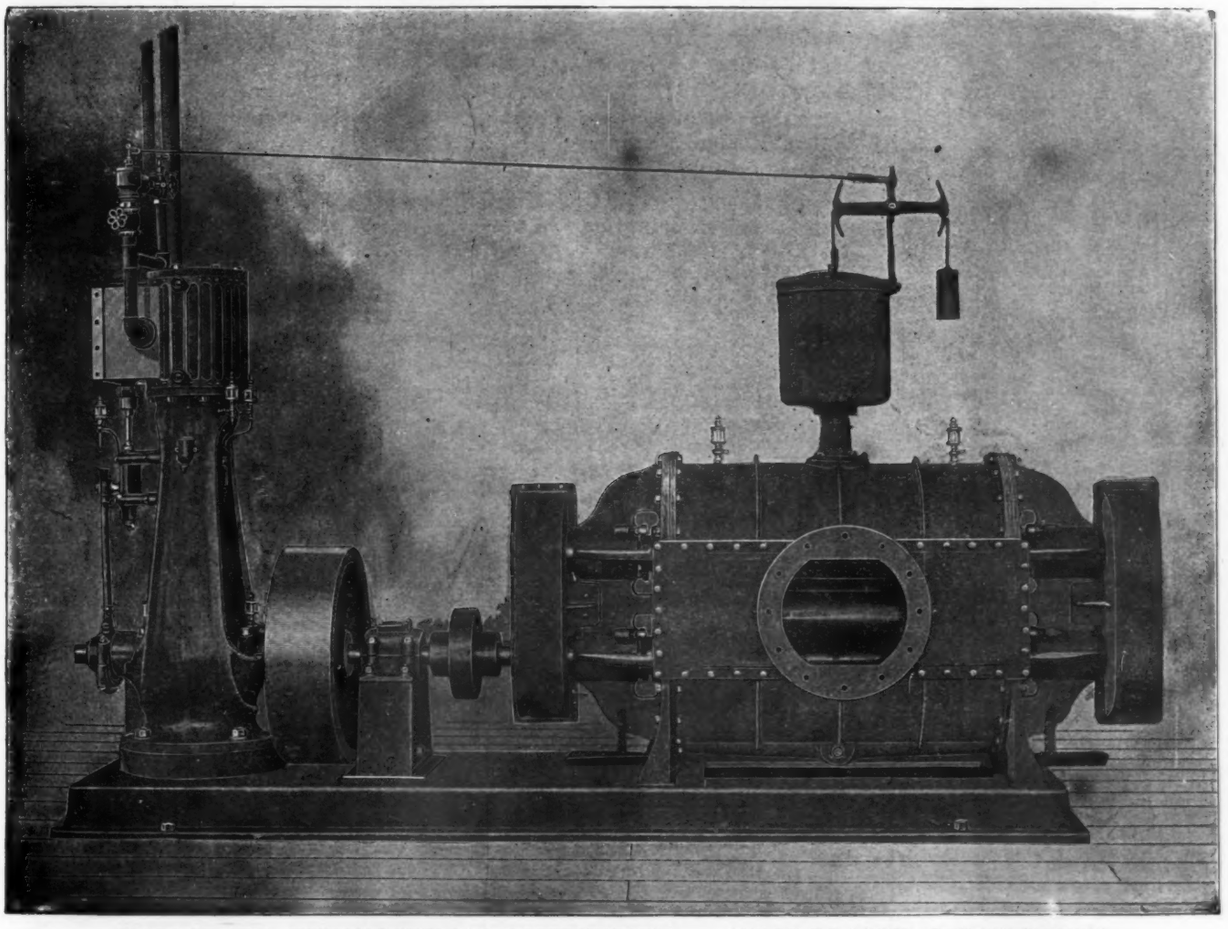
—AND—

NEW GAS GOVERNOR AND STEAM VALVE.

GUARANTEED TO REGULATE WITHIN ONE-TENTH OF AN INCH, WATER PRESSURE.

The Most Perfect Gas Governor on the Market.

MORE DIRECT IN ACTION. FEWER PARTS.
EASIER TO ADJUST THAN ANY OTHER GOVERNOR.



INQUIRIES CHEERFULLY ANSWERED. WRITE FOR CATALOGUE.

P. H. & F. M. ROOTS CO.,

Connersville, Ind. 109 Liberty St., New York.

Eastern Office:

American Gas Company,

222 South Third Street, Philadelphia, Pa.

NEW YORK, 33 NASSAU ST. PHILADELPHIA, 1932 MARKET ST. CHICAGO, 54 LAKE ST.

WELSBACH STREET LIGHTING COMPANY OF AMERICA,

—OWNS, CONTROLS AND OPERATES—
EXCLUSIVELY

THE NEW IMPROVED AND PATENTED STREET LIGHT BURNER.

STYLE No. 81.

Our PATENTED "STREET LIGHT APPLIANCES" have made WELSBACH STREET LIGHTING a complete success.

By the UNIFORM DISTRIBUTION of light on scientific principles a greater area can be lighted by our system and more economically than in any other way.

Where there are no gas mains already laid, we can furnish an equally good light by our **SELF-GENERATING NAPHTHA WELSBACH BURNER,** enabling Gas Companies to furnish a uniform light in all localities.

Lists of Cities and Towns in which we are now lighting under contract will be furnished upon application.

STYLE No. 97.

CORRESPONDENCE SOLICITED FROM GAS COMPANIES AND OTHERS INTERESTED IN MUNICIPAL LIGHTING.

NOW READY.

THE SIXTH (AND CENTENARY) EDITION
— OF THE —

Handbook for Gas Engineers and Managers.

By THOMAS NEWBIGGING, M. Inst. C.E.

This Edition of the "Handbook for Gas Engineers and Managers" is a great improvement on all previous editions Much of the text has been re-written, in order to keep the work abreast of the constant advances that are being made in the Gas Industry.

PRICE, - - $6.00.

A. M. CALLENDER & CO., - - No. 32 Pine Street, N. Y. City.

PRACTICAL HANDBOOK ON

GAS ENGINES

With Instructions for Care and Working of the Same.

By G. LIECKFELD, C.E.

Translated with Permission of the author by GEO. M. RICHMOND, M.E.

Price, $1.00.

A. M. CALLENDER & CO., 32 Pine Street, New York

(Copyrighted, 1894, by the AMERICAN METER CO.

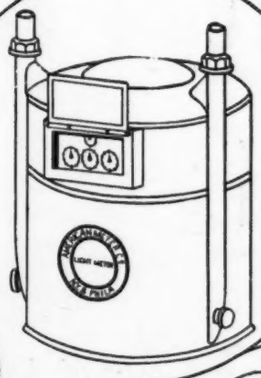
AMERICAN METER CO.

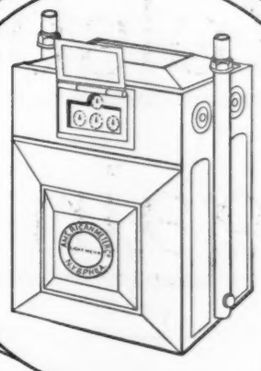
ESTABLISHED 1834. INCORPORATED 1863.

NEW YORK AND PHILADELPHIA,

CHICAGO, ST. LOUIS,

SAN FRANCISCO.

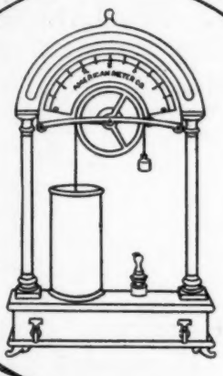


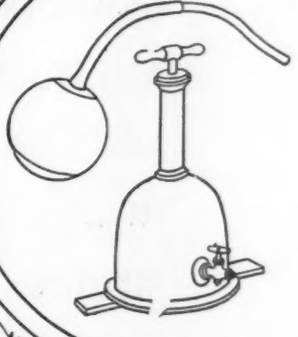


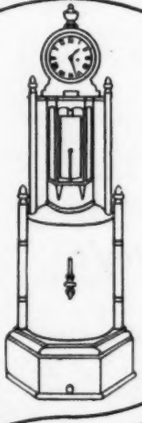
PUBLIC LIGHTING TABLE.

JUNE, 1899.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Thu.	1	7.50 PM	1.50 AM	7.15	3.15
Fri.	2	7.50	2.20	7.15	3.15
Sat.	3	7.50	2.50	7.15	3.15
Sun.	4	8.00	3.30	7.25	3.15
Mon.	5	8.00	3.30	7.25	3.15
Tue.	6	8.00	3.30	7.25	3.15
Wed.	7	8.00 NM	3.30	7.25	3.15
Thu.	8	8.00	3.30	7.25	3.15
Fri.	9	8.00	3.30	7.25	3.15
Sat.	10	8.00	3.30	7.25	3.15
Sun.	11	8.00	3.30	7.25	3.15
Mon.	12	9.30	3.30	7.25	3.15
Tue.	13	9.50	3.30	7.25	3.15
Wed.	14	10.20	3.30	7.25	3.15
Thu.	15	10.40 FQ	3.30	7.25	3 15
Fri.	16	11.00	3.30	7.25	3.15
Sat.	17	11.30	3.30	7.25	3.15
Sun.	18	12.00 AM	3 30	7.30	3.15
Mon.	19	12.40	3 30	7.30	3.15
Tue.	20	1.20	3.30	7.30	3.15
Wed.	21	2.20	3.30	7.30	3.15
Thu.	22	No L.	No L.	7.30	3.15
Fri.	23	No L. FM	No L.	7.30	3.15
Sat.	24	No L.	No L.	7.30	3.15
Sun.	25	8.00 PM	10.20 PM	7.30	3.15
Mon.	26	8.00	10.50	7.30	3.15
Tue.	27	8.00	11.20	7.30	3.15
Wed.	28	8.00	11.50	7.30	3.15
Thu.	29	8.00 LQ	12.20 AM	7.30	3.15
Fri.	30	8.00	12.50	7.30	3.15

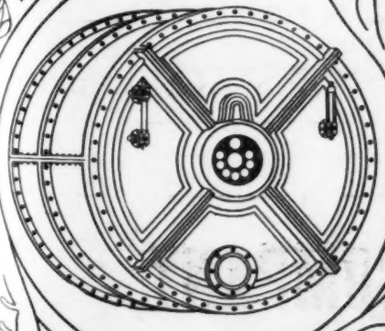


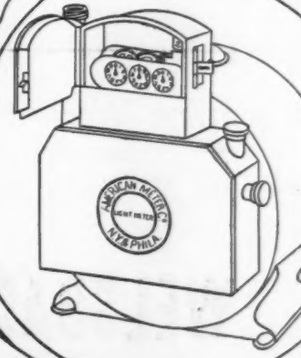




TOTAL HOURS LIGHTING DURING 1899.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	215.40	January	423.20
February	184.40	February	355.25
March	187.40	March	355.35
April	166.50	April	298.50
May	158.00	May	264.50
June	140.50	June	234.25
July	150.30	July	243.45
August	168.30	August	280.25
September	179.50	September	321.15
October	213.20	October	374.30
November	217.00	November	401.40
December	238.10	December	433.45
Total, yr.	2221.00	Total, yr.	3987.45





Welsbach Patent Again Sustained.

Following the recent decision in the United States Circuit Court of Appeals, sustaining Welsbach Company's Patent, Judge Lacombe, in the United States Circuit Court, has enjoined the following manufacturers and sellers:

DAYLIGHT INCANDESCENT GAS LAMP CO.
REX INCANDESCENT GAS LIGHT CO.
AMERICAN INCANDESCENT GAS LIGHT CO.
NEW YORK CHEMICAL REFINING CO.
UNION INCANDESCENT LIGHT CO.
AMERICAN LIGHTING CO.
YOUNG & FLETCHER CO.
HECKLA MANTLE WORKS, Henry Anhalzer, Prop'r.
MERIDEN-ALBERTA MANTLE CO.

All other manufacturers and sellers are cautioned against infringement on the Welsbach Patent and will be held liable for an accounting.

All genuine Welsbach Lights have the trademark "WELSBACH," and are for sale by all first-class dealers in Gas Appliances.

WELSBACH COMMERCIAL COMPANY,

Philadelphia.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

THE STANDARD JUNIOR,

THE STANDARD DOUBLE SUPERHEATER,

LOWE WATER GAS APPARATUS.

Under Contract, 1899:

	SETS.	DAILY CAPACITY.
Fostoria, O.	1	250,000 Cubic Feet.
Derby, Conn.	1	750,000 "
Lowell, Mass.	1	1,000,000 "
Doylestown, Pa.	1	50,000 "
Darby, Pa.	1	400,000 "
Adrian, Mich.	1	125,000 "
Concord, N. H.	1	400,000 "
Sioux City, Iowa	1	750,000 "
Standard Gas Light Co., New York	3	5,400,000 "
Peekskill, N. Y.	1	250,000 "
Westchester, N. Y.	1	250,000 "
Jersey City, N. J.	1	1,000,000 "
Stapleton, N. Y.	1	750,000 "
London, O.	1	125,000 "
Total	16	11,500,000 "
Previously built	294	187,100,000 "
Grand Total	310	198,600,000 "

Established 1858. Incorporated 1890.
CHAS. E. GREGORY Prest. DAVID R. DALY V. Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

E. D. WHITE, President. A. H. GUTKES, Vice-President. H. A. PERKINS, Secretary.

Brooklyn Fire Brick Works,

MANUFACTURERS OF

CLAY RETORTS, FIRE BRICK,
Gas House and other Tile.

Office, 88 Van Dyke St. Brooklyn, N. Y.

Established 1854. Incorporated 1869.

LACLEDE
Fire Brick Manufg. Co.,

Manufacturers of { GAS RETORTS . . .
FIRE BRICK . . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Exclusive Agents for

The Mitchell Half-Depth Regenerative Furnace.

This is the *original* coal-consuming Furnace for Retort Benches. Burns either Coal or Coke. Full and Half-Depth Regenerative Furnaces for Benches of 6's, 7's, 8's or 9's erected complete.

Proprietors of the Coze System of Inclined Retorts.

Office: 901 Pine St., **St. Louis, Mo.**

ESTABLISHED IN 1845.

B. KREISCHER & SONS,

Office, 119 E. 23d St., New York.

Gas Retorts,

TILES, FIRE BRICK.

AND EVERYTHING IN THE FIRE CLAY LINE.

Adam Weber,

Proprietor,

Manhattan Fire Brick and Enameled Clay Retort Works.

Works, Weber, N. J.

Office, 633 East 15th St., New York.

Modern Recuperative Furnaces

And Standard Fire Brick and Gas Retorts.

Works, LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

JAMES GARDNER, JR.,

Hamilton Building, Fifth Avenue PITTSBURGH, PA. P. O. Box 373

Successor to WILLIAM GARDNER & SON

Fire Clay Goods for Gas Works.

SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

PRICE LIST.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD & CO.,

N. 3d & Prospect Avs., Mt. Vernon, N.Y.

Western Agent, H. T. GEROULD, Centralia, Ills.

Parker-Russell Mining and Mfg. Co.,

CITY OFFICE,
417 Pine Street, St. Louis, Mo.

PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

Materials for Gas Companies

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We construct

Half and Full Depth Benches of Our Own Design,

Containing 6, 8 or 9 Retorts.

We have Greatly Improved our Recuperators. Coal or Coke can be used as Fuel in Furnaces.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec'y
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE
RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT BALTIMORE MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK. FIRE CLAY,
AND FIRE CEMENT.

Red and Buff Ornamental Tiles and Chimney Tops. Baker Oven Tiles 12x12x2 and 10x10x2.

WALDO BROS., 102 MILK ST., BOSTON, MASS.

Sole Agents for New England States.

PRACTICAL PHOTOMETRY.

A Guide to the Study of the Measurement of Light.

By WILLIAM JOSEPH DIBDIN.

With Numerous Illustrations. Price, $3.00 A. M. CALLENDER & CO., 32 Pine Street, N. Y. City

National Gas and Water Company.

CONTRACTORS FOR
Gas Plant Machinery

SOFT COAL OR COKE
WATER GAS GENERATORS
A SPECIALTY.

218 LA SALLE ST.,
CHICAGO.

Gas Engineers
INSPECTION AND ADVICE.

PLANS AND ESTIMATES
FOR IMPROVEMENTS OR
REPAIRS.

CONNELLY IRON SPONGE AND GOVERNOR CO.,

(Successors to CONNELLY & CO.)
MANUFACTURERS OF GAS WORKS SPECIALTIES.

"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying material ever offered as a substitute for lime. We guarantee a large saving, both in cost of material and labor.

AUTOMATIC GOVERNOR.
OVER FOUR HUNDRED NOW IN USE! NO WORKS COMPLETE WITHOUT IT!
WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION!
REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE!
IT IS THE ONLY RECOGNIZED AUTOMATIC GOVERNOR IN THE WORLD!

STEAM JET EXHAUSTER. Designed particularly for small works. Combines Exhaust Tube, Steam Governor, Gas Compensator and Bye-Pass Valves in the most compact form possible. Occupies but little space; uses very little steam; saves formation of carbon in retorts; increases yield 10 to 15 per cent. No works too small to use them profitably.

Prices given on all our specialties, delivered at any point in the United States. Correspondence solicited.

CONNELLY IRON SPONGE AND GOVERNOR CO., No. 357 Canal St., New York.

Hughes'
"Gas Works,"
Their Construction and Arrangement,
And the Manufacture and Distribution of Coal Gas.

Originally written by SAM'L HUGHES, C.E.

Rewritten and Much Enlarged by
WM. RICHARDS, C.E

Eighth Edition, Revised, with Notices of Recent Improvements.

Price, $1.65.

A. M. CALLENDER & CO.,
32 Pine St., N. Y. City.

IRON MASS
For Gas Purification.
Acts immediately, and more efficiently than any other purifying agent now in use.
GREENPOINT CHEMICAL WORKS,
Greenpoint Ave. and Newtown Creek, Brooklyn, N. Y.

The Chemistry of Illuminating Gas.
By NORTON H. HUMPHRYS. Price, $2.40.
A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY

Cyanogen.
A PURIFYING MATERIAL FOR GAS.
Soft and porous, it can be used in the natural state without any preparation, and it ensures perfect purification.
SPECIMENS AND PRICES ON APPLICATION.

VAN BAARDA & CO.,
MINE OWNERS,
DUSSELDORF-ON-THE-RHINE.

Parson's Steam Blower,
FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREZEE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER,
FOR USING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER,
FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial*. No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON, Supt., 67 Bremen Street, Brooklyn, N. Y.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

Ocean Mine Youghiogheny Gas Coal,
Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully prepared.
For Gas Making or
Heavy Steaming.

SCIENTIFIC BOOKS.

NEWBIGGING'S HANDBOOK. By Thos. Newbigging. 6th edition. $6.

COX'S GAS FLOW COMPUTER. $2.50.

HUGHES' GAS WORKS. $1.65.

POOLE ON FUELS. By Herman Poole. $3.

GAS ENGINEER'S POCKET-BOOK. By Henry O'Connor. $3.50.

TECHNICAL GAS ANALYSIS. $3.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards. 20 cents.

CHEMISTRY OF ILLUMINATING GAS. By Norton H. Humphrys. $2.40.

PRACTICAL TREATISE ON HEAT By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $5. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

GAS WORKS: Their Arrangement, Construction, Plant and Machinery. $5.

PRACTICAL HANDBOOK ON GAS ENGINES, by G. Lieckfield. $1.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

COAL: Its History and Use. By Prof. Thorpe. $3.50.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

GASFITTER'S GUIDE, by John Eldridge 40 cents.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2

CONSTRUCTION OF GAS WORKS, by Walter Ralph Herring. $2.

DIGEST OF GAS CASES. $5.

PRACTICAL HINTS ON REGENERATOR FURNACES By M. Graham. $1.25.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR. By Geo. Lunge. New edition. $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby. $2.50.

GAS LIGHTING AND GAS FITTING. By W. P. Gerhard. 50 cents.

PRACTICAL PLUMBING. By P. J. Davies. $3.

AMERICAN PLUMBING. By Alfred Revill. $2.

CEMENT; A Manual of Lime and Cement, their Treatment and Use in Construction. By A. H. Heath. $2.50.

A COMPARISON BETWEEN THE ENGLISH AND FRENCH METHODS OF ASCERTAINING THE ILLUMINATING POWER OF COAL GAS. $1.60.

ELECTRICITY.

INDUSTRIAL PHOTOMETRY, with Special Application to Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Kapp. $3.50.

ELECTRICIAN'S POCKETBOOK. By Monroe and Jamieson. $2.50.

MAGNETISM AND ELECTRICITY. By J. Overend. 40 cts

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker. $3.

ELECTRIC LIGHT FITTING. $2.

PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications. By John T. Sprague. $6.

The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order. No books sent C.O.D.

A. M. CALLENDER & CO., 32 Pine Street, New York.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, - - Clarksburgh, Harrison Co., West Va.
WHARVES, - - - Locust Point Baltimore, Md.
OFFICE, - 640 Equitable Building Baltimore, Md.

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS, { BANGS & HORTON 60 Congress St., Boston.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

Do You Wish to Know

what size of pipe to use to convey any quantity of gas, any distance, with any loss of pressure and any initial or final pressure? Then use

Cox's Gas Flow Computer,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50. For sale by

A. M. Callender & Co., 32 Pine St., N. Y.

GREENOUGH'S "DIGEST OF GAS CASES."

Price, $5.00.

This is a valuable and important work, a copy of which should be in the possession of every gas company in the country, whether large or small. As a book of reference it will be found invaluable. It is the only work of the kind which has ever been published in this country, and is most complete. Handsomely bound. Orders may be sent to

A. M. CALLENDER & CO., 32 Pine St., N. Y.

— THE —

PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened and Prepared for Gas Purposes.

Their property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

Room 720, Reading Terminal Building, Phila., Pa.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River: Pier No. 1 (Lower Side), South Amboy, N. J.

EDMUND H. McCULLOUGH, Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J., WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

THE SUN OIL CO.

Crude Oil, Gas Naphtha,
Refined Petroleum, Gas Oil.

Toledo, O., and Pittsburgh, Pa.

Standard Oil Company,

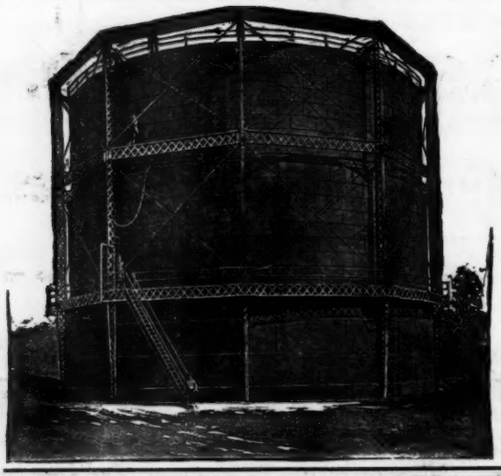
GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

Correspondence Solicited.

26 Broadway, New York City.



DAVIS & FARNUM MFG. CO.,
WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Borrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

BAXTER & YOUNG,
CONTRACTING AND CONSULTING GAS ENGINEERS.

Examination and Values Ascertained of Artificial and Natural Gas Properties.

COMPLETE GAS WORKS ERECTED.

Artificial and Natural Gas Mains Furnished and Laid.

CORRESPONDENCE SOLICITED.

OFFICE: WAYNE COUNTY BANK BUILDING, Rooms 201 & 202. DETROIT, MICH.

A. E. BOARDMAN, C. E.,
Consulting and Contracting Engineer.

Particular attention given to Gas, Water and Electric Plants. Long and successful experience with the problem and practice of

Filtration for Public Water Supply.

BREVARD, N. C.

JAMES T. LYNN,
GAS ENGINEER AND CONTRACTOR,

Wayne Bank Building, - DETROIT.

GAS PROPERTIES PURCHASED.

Geo. Shepard Page's Sons.
GAS MACHINERY.

Correspondence Solicited.

69 Wall Street, New York City.

DAVID LEAVITT HOUGH,
Consulting Engineer AND CONTRACTOR,

374 FIFTH AVE., N. Y.

Kerr Murray Manufacturing Company,
Steel Gasholder Tanks,
SINGLE, DOUBLE AND TRIPLE-LIFT GASHOLDERS,
HORIZONTAL AND VERTICAL STORAGE OIL TANKS

Iron Work for Coal Gas Benches, Self-Sealing Mouthpieces, Exhausters, Condensers, Scrubbers, Purifiers, Wooden Trays, Floor Carriages, Center Seal and Valve System Connections, Cast and Wrought Iron Fittings, and Connections 3 to 36 Inches Diameter.

VALVES, Double Gate, Hub and Flange, Outside Screw and Quick Opening, 3 to 36 In. Diam.

COAL AND COKE WAGONS, RETORT HOUSE TOOLS, STREET MAIN SPECIALS AND DRIPS.

Address.

KERR MURRAY MANUFACTURING CO.
Fort Wayne, Indiana.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Triple, Double and Single-Lift Gasholders.

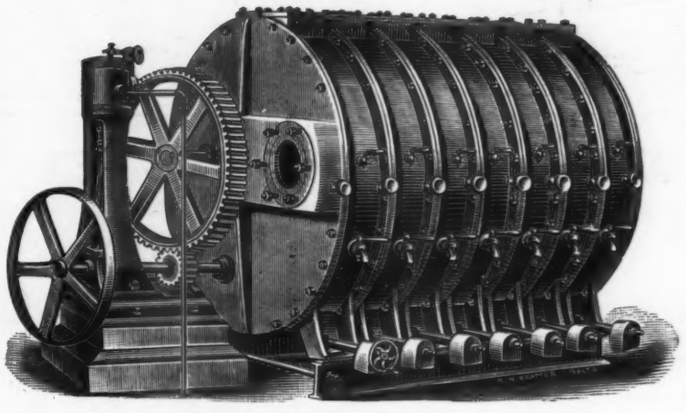
Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS

PURIFIERS.



CONDENSERS.

Scrubbers.

Bench Castings.

OIL STORAGE TANKS

Boilers.

PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Discs, thus reducing the weight on shaft and power for operating same.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSIBLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

MILL'S REVERSIBLE LIME TRAYS.

Gas Works Designed and Constructed.

EXCERPTS FROM DECISIONS

—OF THE—

BOARD OF GAS COMMISSIONERS of the COMMONWEALTH OF MASSACHUSETTS.

MR. E. H. YORKE, NEW HAVEN, CONN., Dec. 1, 1898.

Dear Sir:—I am in receipt of a copy of "Excerpts from the Decisions of the Board of Gas Commissioners," which is a handy compilation in book form of extracts from the most recent decisions of the Gas Commission of Massachusetts.

I note that most of these extracts are broad and safe-guiding precepts, which apply with equal force to one Company as to another. The 13 years' existence of the Board of Gas Commissioners with its unusual opportunities for acquiring information, have justly made it a high and safe authority in all matters pertaining to the management, obligations, and rights of Gas Companies. Your little book will serve as a valuable reference library in settling legal complications which often arise between a Gas Company and its customers.

Yours truly, (Signed) F. C. SHERMAN, Superintendent.

A 28-page Pamphlet containing the cream of this Board's decisions as to the proper management of Gas Companies.

Compiled by E. H. YORKE. Price $1.00. Address

A. M. CALLENDER & CO., - No. 32 Pine Street, N. Y. City.

R. D. WOOD & CO., ENGINEERS. IRON FOUNDERS. MACHINISTS.

400 Chestnut Street, Philadelphia, Pa.

MANUFACTURERS OF

CAST IRON PIPE.

BUILDERS OF

Gas Holders,

Single, Double and Triple Lifts, with or without Wrought Iron or Steel Tanks.

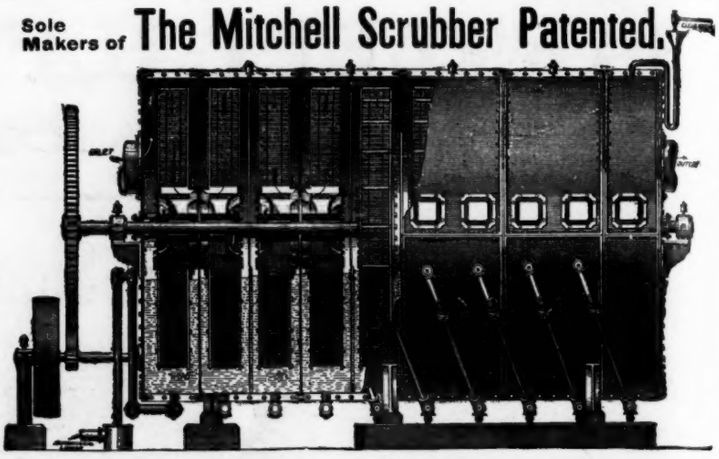
PURIFIERS, CONDENSERS, SCRUBBERS.

The Hopper Automatic Gas Governor

Send for Pamphlet.

Dunham Patent Specials.

Sole Makers of **The Mitchell Scrubber Patented.**



ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

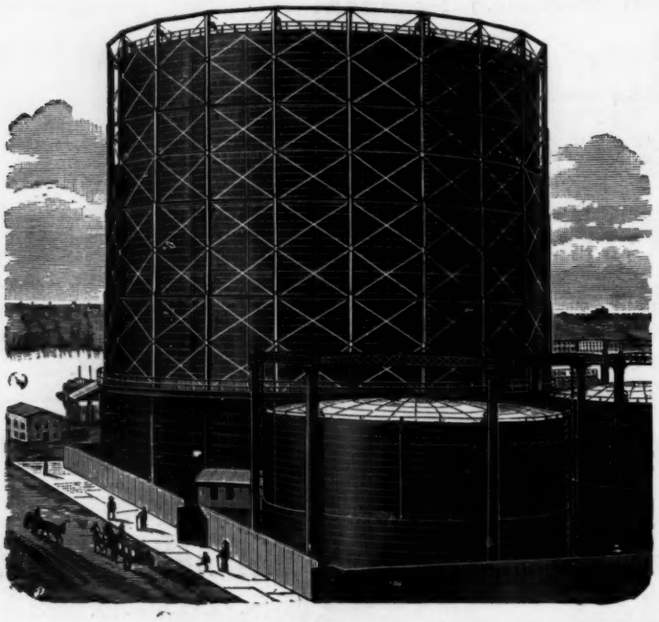
FOUNDERS AND MACHINISTS.

MANUFACTURERS OF

All Ironwork and Machinery Required in a Gas Plant.

Estimates, Drawings and Specifications furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

245 Broadway, New York City. OFFICES **Bridge & Ogden Sts., Newark, N. J.**



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

West and Calyer Sts. (Near 10th & 23d St. Ferries)
NEW YORK, Borough of Brooklyn.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

STEEL GAS HOLDER TANKS.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

ILLUMINATING GAS! FUEL GAS!

THE LOOMIS PROCESS.

Now in successful operation at Works of John Russell Cuttlery Co., Turner's Falls, Mass., and Henry Disston's Son's Saw Works, Tacony, Pa.

The Cheapest Gas Generating System in the World.

Plans and Estimates Furnished.

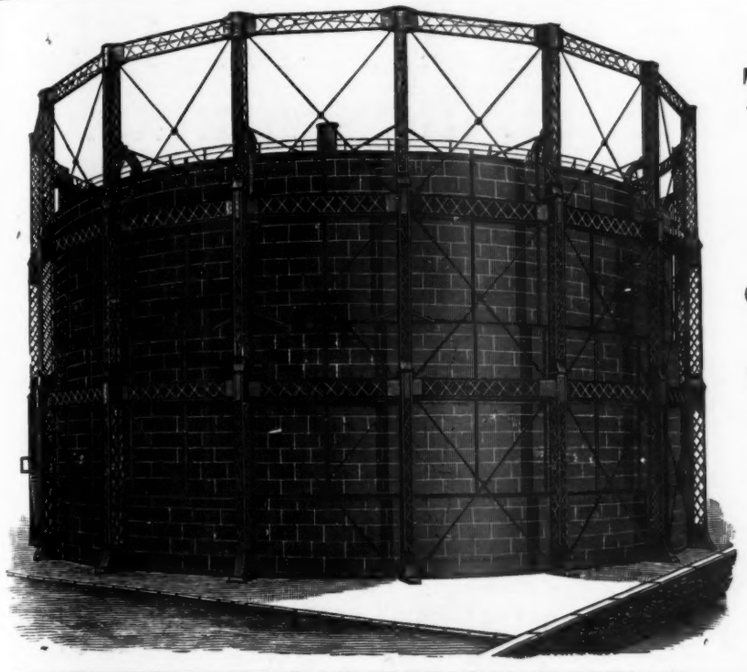
BURDETT LOOMIS, - - Hartford, Conn.

To Gas Companies.

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,
248 N. 8th St., Phila., Pa.



H. RANSHAW, Prest. & Mangr. T. H. BIRCH, Asst. Mangr
WILLIAM STACEY, Vice-Prest. R. J. TARVIN, Sec. & Treas.

THE STACEY MANUFACTURING CO

Established 1851.

Single, Double and Triple-Lift

GASHOLDERS,

Of any Capacity, with or without Wrought Iron or Steel Tanks.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, etc.

Coal Gas Benches, Roof Frames,

OIL STORAGE TANKS.

Pressed Steel Mouthpiece Lids, Self-Sealing Mouthpiece Lids.

Cincinnati, Ohio.

RITER-CONLEY MFG. CO.,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. **EASTERN OFFICE: 39-41 Cortlandt St., New York City.**

WM. HENRY WHITE,

No. 32 Pine Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

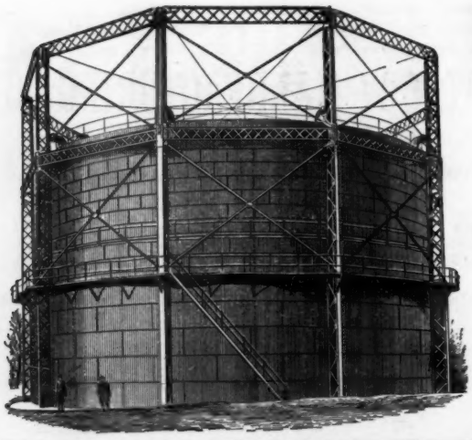
Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited.
Plans and Estimates Furnished.

1899 DIRECTORY 1899

OF AMERICAN GAS COMPANIES

Price - - - - - - - - - $5.00.

A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.



1842 ⁂ Deily & Fowler, ⁂ 1899

LAUREL IRON WORKS.

Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.

JAMES R. FLOYD'S SONS,

Successors to HERRING & FLOYD,
Oregon Iron Works,

West 20th and 21st Streets, Between 10th & 11th Avenues, New York City.

Engineers and Contractors for the Construction of Gas Works.

MANUFACTURERS OF ALL KINDS OF CASTINGS AND GENERAL IRONWORK FOR GAS APPARATUS.

Bench Castings, Regenerative and Half Regenerative Furnace Castings, Condensers, Tower Scrubbers, Mechanical Scrubbers, Purifiers, Malleable Iron Retort Lids, Self-Sealing Retort Lids, Hydraulic Hoist Purifier Carriage, Crosses, Tees, Bends, Angles, Reducers, S-Bends, Sectional Sleeves, Plugs, Caps, Street Drips, etc., always on hand.

WOOD'S GAS SCRUBBING AND ENRICHING APPARATUS.

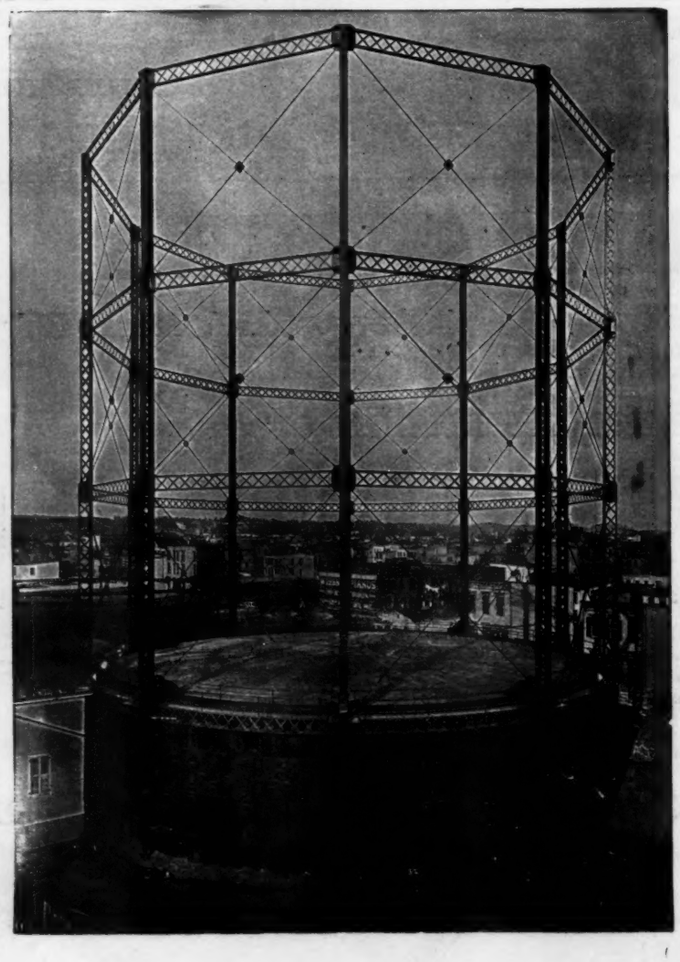
In use at Syracuse, Auburn, Watertown, Cortland and Geneva, N.Y.; Elizabeth, N. J.; Boston, Mass.; Jamaica Plain, Mass.; Providence, R. I.; Northern Liberties Gas Co., Phila.

Sole Manufacturers of the OGDEN QUICK-MOVING VALVE.

HEARNE CENTER SEAL, Operating One, Two, Three or Four Boxes.

Stroh & Osius Concentrator for Ammoniacal Liquor, used by 50 Gas Companies and Cokeries during the past 4 years.

The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 Cu. Ft.



LOGAN IRON WORKS,

Brooklyn, N. Y.

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete with Steel Tanks.

BENCHES, SCRUBBERS,
CONDENSERS,
PURIFIERS, IRON ROOFS,
Self-Sealing Retort Lids,
AND ALL PARTS OF
GAS WORKS APPARATUS.

Contractors for
Complete Works.

ALSO, SOLE MANUFACTURERS OF

C. W. BLODGET'S
HOT GAS SCRUBBER.

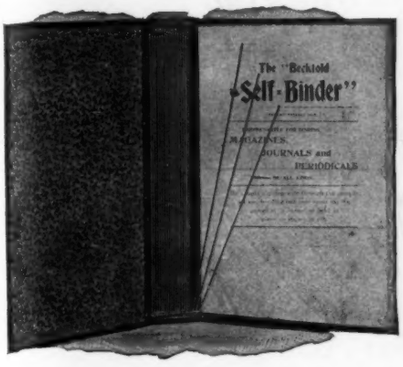
YOU CAN GET A PATENT

For any invention. Send me particulars and a rough sketch for advice, free.

IMPORTANT to have your attorney at Washington, saving time and expense.

HENRY S. THORNBERRY, Patent Solicitor,
1427 F STREET, N. W., WASHINGTON, D. C.

BINDER for the JOURNAL.



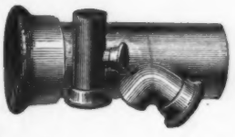
Price $1.00.

A. M. CALLENDER & CO., 32 Pine Street, N.Y.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.



CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches. Bends, Retorts, etc., etc

"GLOBE" SPECIALS, VALVES, ETC. M. J. DRUMMOND & CO. "GLAMORGAN" FIRE HYDRANTS

MANUFACTURERS OF CAST IRON

GENERAL SALES OFFICE, 192 BROADWAY, NEW YORK.

Western Office: Monadnock Block, Chicago, Ills.

GEORGE ORMROD, Mangr. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

CHARLES MILLAR & SON, Selling Agents, Utica, N. Y.

Flanged Pipe and Fittings, Hydrants, Gates, Pig Lead, Jute, etc.

Manufacturers of Lead Pipe, Solder, etc., also a full line of Plumbers' and Tinners' Goods.

CAST IRON PIPE and SPECIALS FOR WATER AND GAS.

Wholesale Eastern Agents AKRON VITRIFIED SEWER PIPE.

Established 1854.

D. McDONALD & CO.,

MANUFACTURERS OF

WET AND DRY METERS, STATION METERS AND METER PROVERS.

—ALSO MAKERS OF

THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES

OVER 30,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

Correspondence Solicited.

511 West Twenty-first Street, NEW YORK. | 51, 53 & 55 Lancaster Street, ALBANY, N. Y. | 34 & 36 West Monroe Street, CHICAGO.

NATHANIEL TUFTS METER CO.

ESTABLISHED 1849. No. 8 Medford Street, BOSTON, MASS.

Manfrs. of Consumers', Station, Test and Experimental Meters.

Sole New England Agents for the

PERFECT GAS RANGES.

In competitive tests it shows the greatest Efficiency, Durability, and Saving in Repairs.

Made in four grades, with Price and Size to suit any condition. We Guarantee every Range.

SEND FOR A SAMPLE AND MAKE YOUR OWN TESTS.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

BALTIMORE, North & Saratoga Sts. **CHICAGO, 107 West Monroe St.**
SAN FRANCISCO, 221 Front St.

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.

"Perfect" Gas Stoves

Now, doesn't it stand to reason that

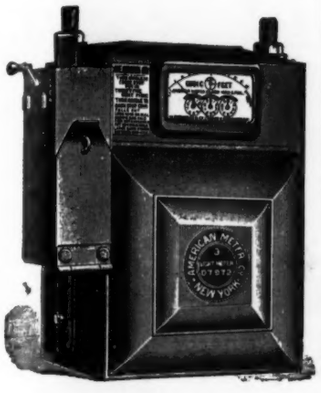
OUR METERS MUST BE ALL RIGHT,

else how could we

STICK TO BUSINESS AND KEEP A-YELLIN'

all these years?

THE KEYSTONE METER CO.,
Royersford, Pa.



American Meter Co.

NEW YORK, PHILADELPHIA,
SAN FRANCISCO.

Prepayment Meters.

Their construction is such that they may be readily readjusted when the scale of gas rates is changed.

HELME & McILHENNY,

Established 1848. 1339 to 1349 Cherry Street, Philadelphia, Pa.

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

WITH A VERY FULL COLLECTION OF TABLES OF HEATS OF COMBUSTION OF FUELS, SOLID LIQUID AND GASEOUS.

TO WHICH IS ALSO APPENDED

THE REPORT OF THE COMMITTEE ON BOILER-TESTS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS DECEMBER (1897); TABLES OF CONSTANTS USED.

By HERMAN POOLE, F.C.S.

FIRST EDITION.

Price $8. For Sale by

A. M. CALLENDER & CO. - - No. 32 Pine Street, New York City.

The advertisement of

THE WESTERN GAS CONSTRUCTION COMPANY, Engineers and Builders,

Improved Double Superheater Lowe Water Gas Apparatus—Manufacturers of General Gas Works Machinery—Builders of Gas Works

WM. HENRY WHITE, Eastern Engineer, 32 Pine St., New York.

FORT WAYNE, IND.,

Occupies this space every alternate week

JOHN J. GRIFFIN & CO.,

1513-1515-1517-1519-1521 Race Street, Philadelphia.

52 Dey Street, New York. WM. S. GRIBBEL, Manager.

75 N. Clinton St., Chicago. FREDERICK WAUGH, Manager.

MANUFACTURERS OF

STATION METERS, CONSUMERS' METERS,

Provers, Registers, Gauges, Experimental Apparatus, Etc.

Prompt Attention Given to All Repairing.

OUR SPECIAL NATURAL GAS METER

Is the Best ever offered. Over 30,000 now in use.

We manufacture in the United States, under the SAWER & PURVES PATENTS, the

Positive Prepayment Meter.

. . SIMPLE . .

. DURABLE .

. ACCURATE .

. RELIABLE .

All Parts Interchangeable

This Meter is an unqualified success in Great Britain. Its simplicity of construction, and the positive character of the service performed by it, have given it pre-eminence.

Needs Only the Care Given an Ordinary Meter.

Saves MONEY, TIME and CONSUMERS.

Dispenses with "DEPOSITS" and Increases OUTPUT.